SCIENTIFIC AMERICAN

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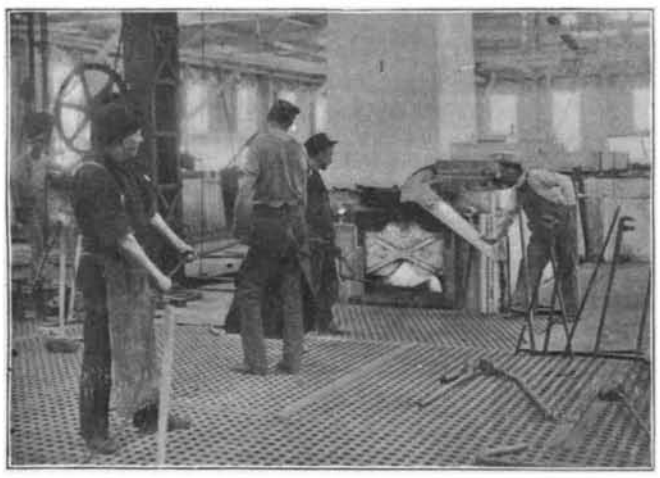
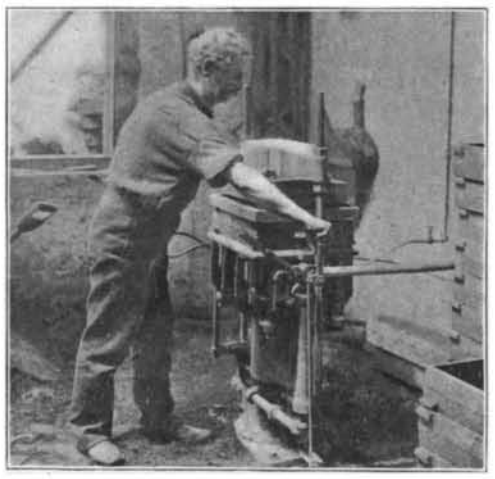
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

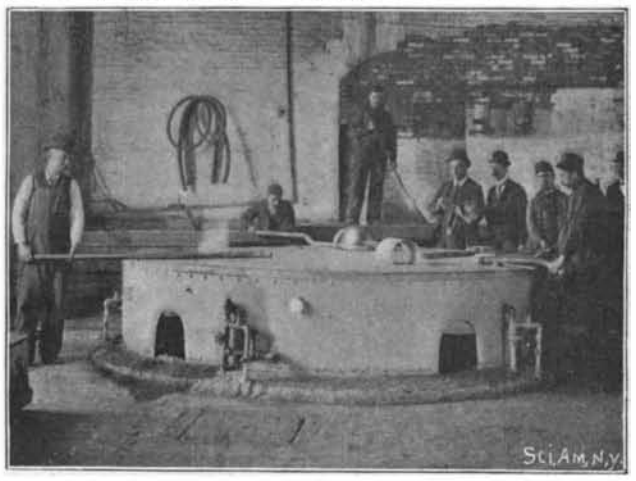
Vol. LXXXII.—No. 9. ESTABLISHED 1845. | NEW YORK, MARCH 3, 1900. | $3.00 A YEAR. WEEKLY.



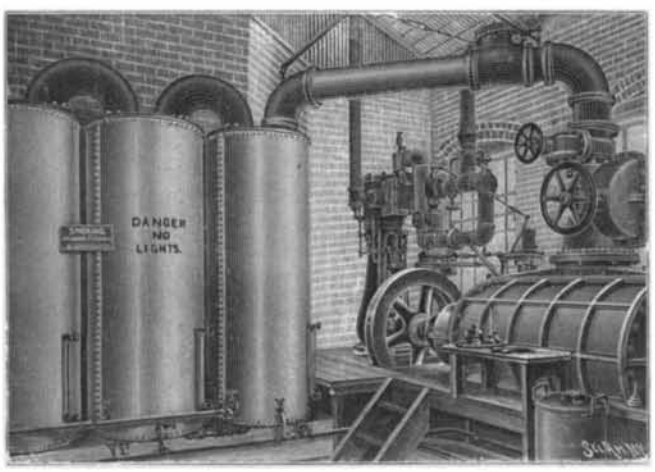
Furnace for Bending and Beveling Angle Iron.



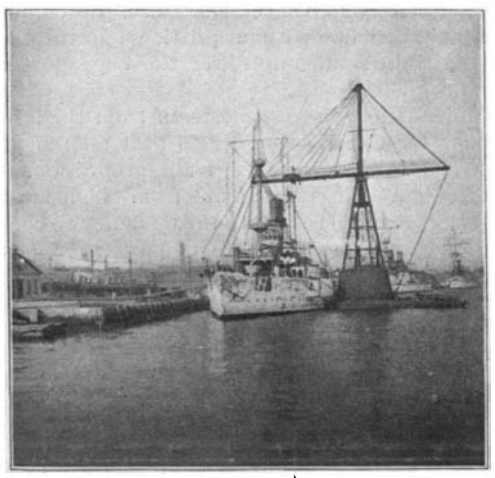
Pneumatic Molding Machine.



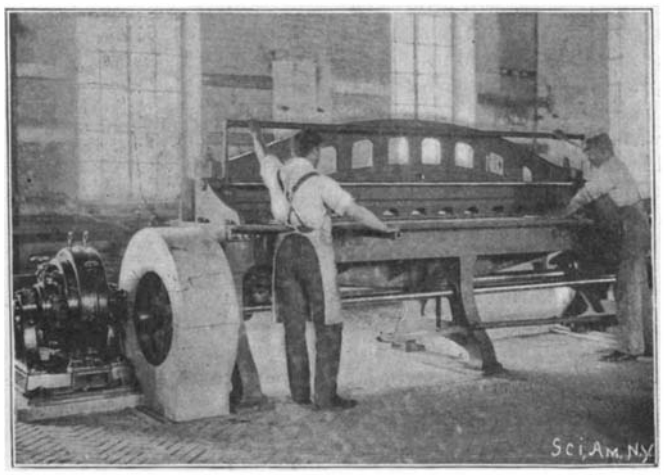
Gas-fired Coppersmith's Forge.



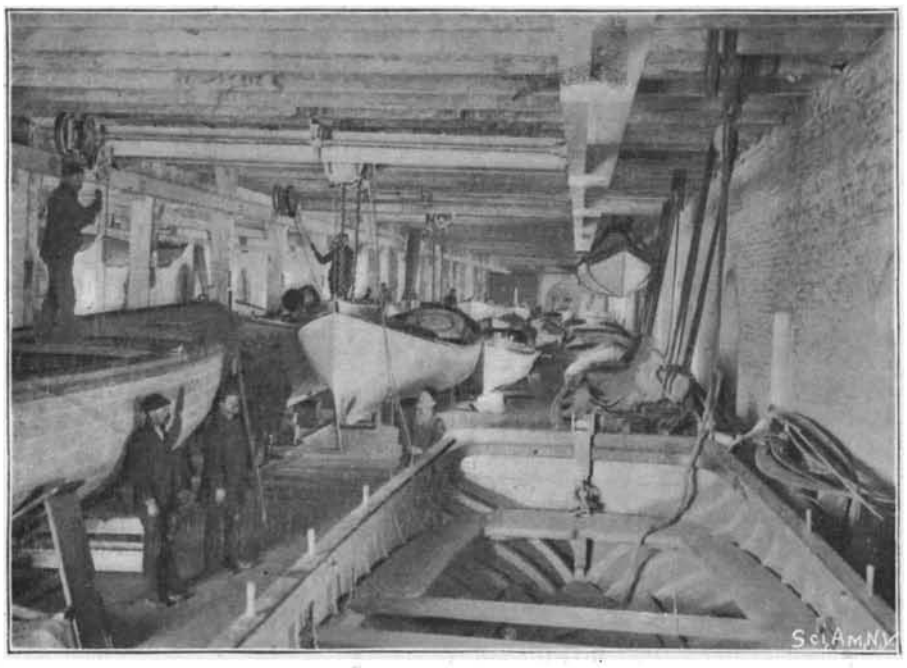
The Gas Plant.



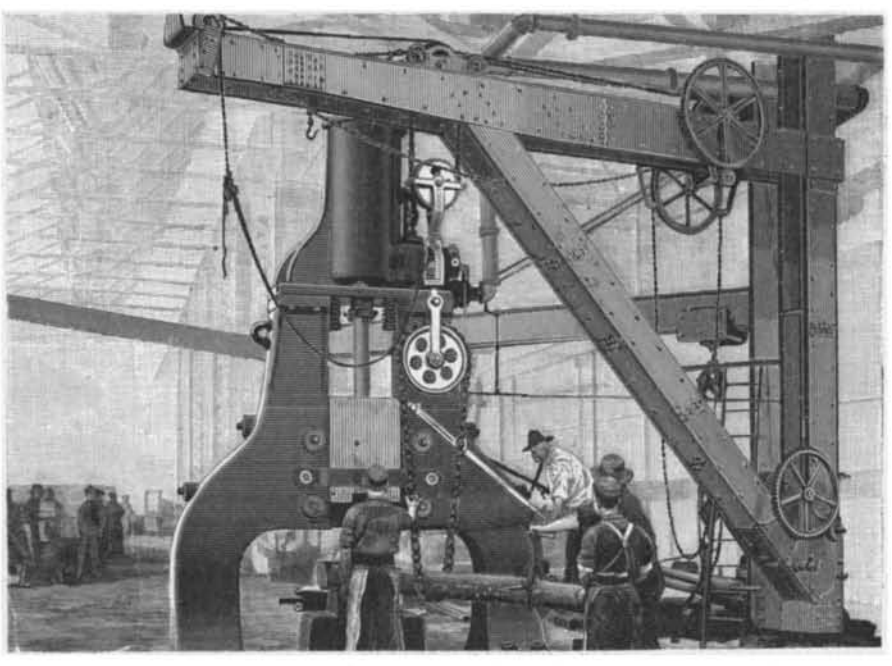
75-ton Floating Derrick Alongside the "Texas."



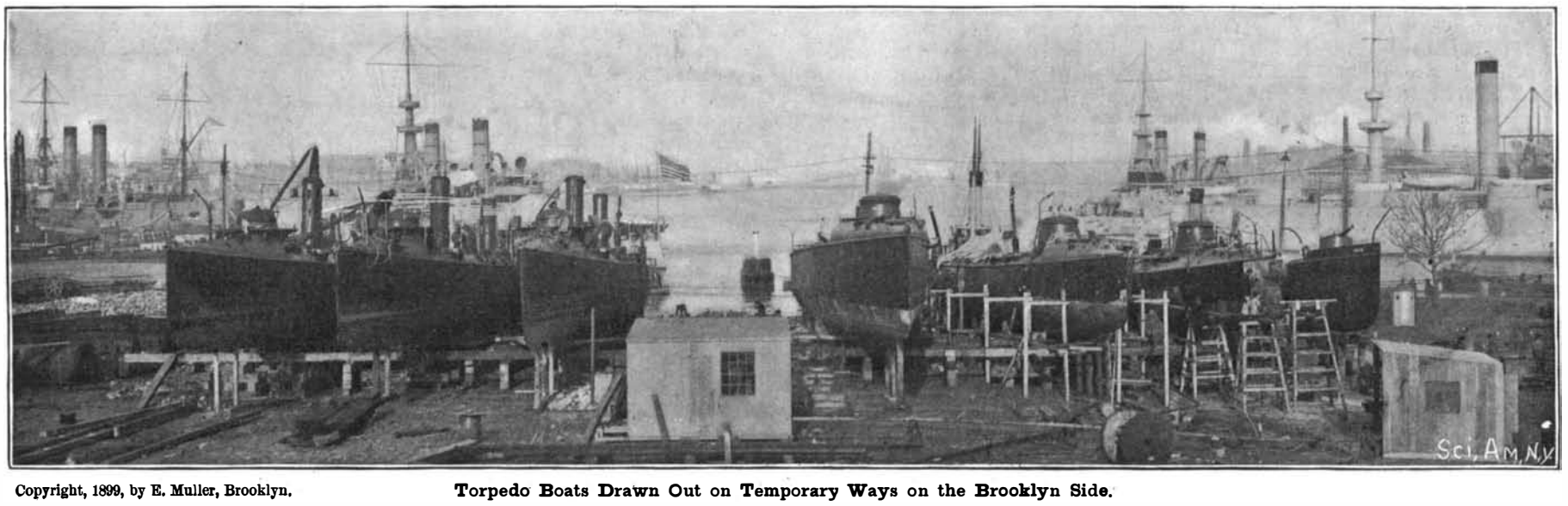
Direct-Connected, Electrically-Driven Shears.



The Boat Storehouse, Showing Boat Being Moved by Overhead Trolley.



The Smithery—Forging an 8-inch Davit.



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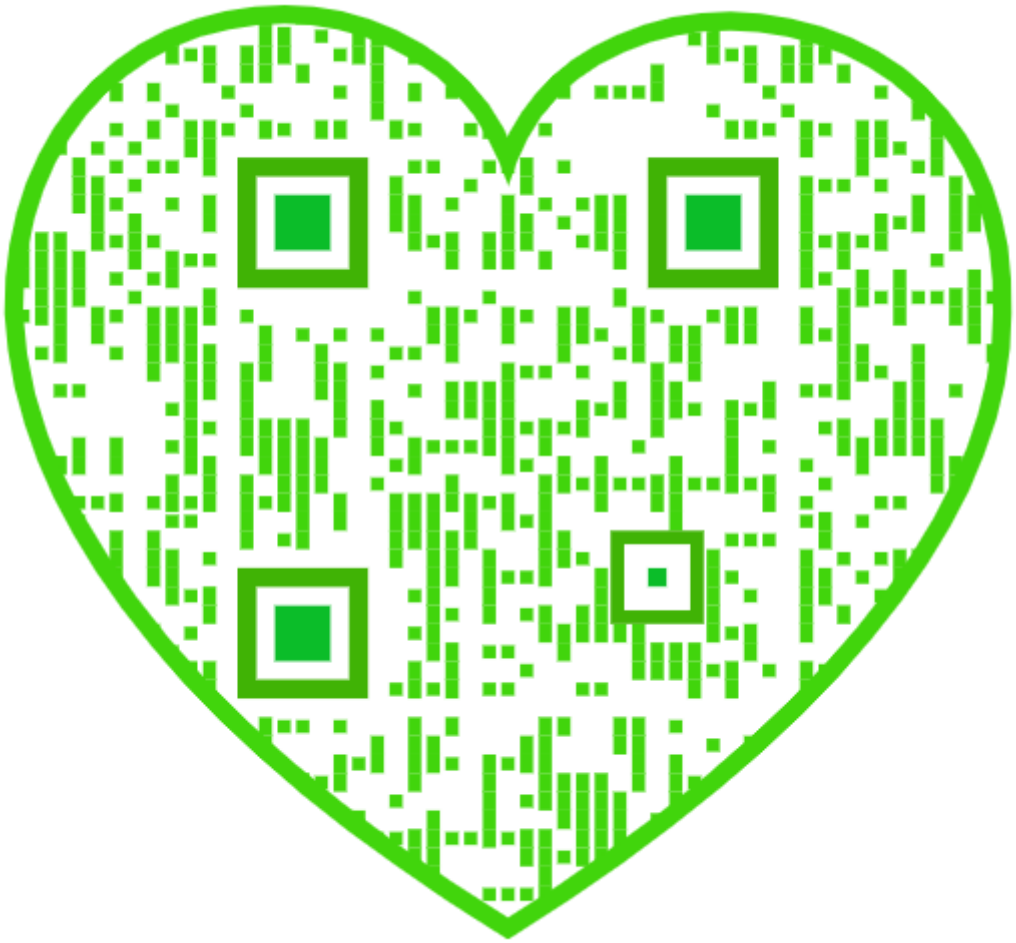
Torpedo Boats Drawn Out on Temporary Ways on the Brooklyn Side.

THE NEW YORK NAVY YARD, BROOKLYN.—[See page 138.]



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MARCH 3, 1900.

THE IDEAL AUTOMOBILE.

The automobile has been sufficiently long in our midst to enable us to define the essential qualities which go to make up an ideal machine. Naming them in their order they are as follows: low cost, durability, endurance (large fuel supply), ability to climb hills, and speed.

Low cost is given the first place for the reason that the present price of the automobile places it altogether beyond the means of the average individual, and renders it a very decided luxury. It is certain that cheapening the cost will produce a proportionate increase in the demand, and the increased demand will lead in its turn to a reduction in the price. This was conclusively proved in the history of the bicycle, the cost of a first-class machine to-day being about one-quarter what it was a few years ago, when the number of riders was limited.

But while the ideal automobile must be cheap the reduction in price must not be gained at the expense of sound materials and good workmanship. However great may be the demand for a low-priced machine, our manufacturers must never attempt to meet it by making a short cut by the way of showy but inferior construction. The folly of such a method was demonstrated very conclusively when the bicycle was at the height of its popularity.

Next to its low cost and durability we place the endurance of the automobile; by which we mean its capacity to cover a large mileage without having to refill its fuel tanks. Liberal fuel capacity will be a very strong recommendation to the bicyclist, who has been accustomed to rove all day on long-distance excursion with the knowledge that he is not tied to particular stopping places, or liable to be hopelessly "stalled" by a collapse of his motive power in out-of-the-way or unexpected places.

In view of the fact that the steam-driven automobile has shown such superior hill-climbing powers, it is certain that the appetite of the public, being thus whetted, will demand that the ideal automobile shall be able to negotiate any hill that it may encounter in the course of an extended tour. It must be able to carry its occupant through, if need be, a mountainous country; for we have a precedent in the successful trip up Mount Washington recently accomplished by a builder in one of his own machines. The records for hill-climbing are at present held by steam-driven motors; and it will be a fortunate day for the automobilists when builders succeed in combining with the cheap cost of operation of the gas-propelled type, the hill-climbing powers of its strongest competitor.

In placing speed at the bottom of the list we may seem to be making too little of a feature of the automobile which many of the riding public believe should receive the first consideration; but as a matter of fact, every type of automobile that is now on the market is capable of running at a higher speed than the law allows. Although a rate of twenty miles an hour or more is no doubt frequently accomplished on the public roads, there is no question that the rapid increase in the number of riders in the future will lead to a restriction of speed to a maximum of twelve or fourteen miles an hour.

PROSPECTS OF THE PEARY RELIEF EXPEDITION.

The outlook for Peary's Polar expedition does not seem very bright, as great difficulty is experienced in finding a steamer and a crew suitable for a three years' sojourn in the Arctic regions. The "Windward" was a slow boat and was hardly adapted for the purpose. She was sent back last August to the Peary Arctic Club which has already spent $64,000 on the expedition, and it is evident that they will have to raise a large sum of money to enable the plans to be satisfactorily carried out. Either a Newfoundland sealing steamer will have to be purchased, or the "Windward" will have to be repaired. It is almost impossible to lease a steamer owing to the fact that they are all needed in seal fishery. It was hoped that a second-hand set of engines and boilers could be obtained for the "Windward," but up to the present time nothing of the kind seems available, and the engines will probably have to be patched up to answer. It is found very difficult to get twelve men to venture north this year with the prospect of not returning for three years. It is to be hoped that the explorer will not be balked in his plans, as his disappointment will be a bitter one.

ELECTRIC TRAIN LIGHTING.

BY ALTAN D. ADAMS.

The very general use and appreciation of the incandescent electric lamp for stationary lighting has suggested its adoption on railway trains. A number of more or less satisfactory attempts at electric train lighting have been made and cars are thus lighted on several regular trains in different parts of the country. The methods of electric train lighting thus far tried with success may be divided, as to their sources of power, into three classes. On one plan an engine, served with steam from the locomotive boiler, is used to drive a dynamo in the baggage car, and suitable conductors are supplied to connect the dynamo with electric lamps in all the cars of a train. As lamps can only be operated by dynamo current in the several cars, so long as they are coupled to the baggage car and locomotive, a storage battery on each car, or at least on the baggage car, is necessary to make the steam-driven engine and dynamo at all satisfactory. With a storage battery of suitable capacity on each car, enough energy from the dynamo may be stored during the times when the train is connected up to light the several cars when they are being switched or a change of engines is being made. If the battery is placed entirely in the baggage car, the change of engines may be made without putting out the lamps, but if the train is uncoupled, or the baggage car removed, darkness ensues.

One objection to the use of steam from the locomotive boiler for electric lighting, is that all the power possible is usually wanted for train propulsion. It is also objectionable to pipe steam from the locomotive to the baggage car, because of the tendency to condensation losses. Another source of power for electric lighting on trains is found at the car axle. In order to deliver energy at constant pressure, as is necessary for incandescent lighting, the ordinary dynamo must be driven at a uniform speed, but by special and somewhat complicated construction dynamos are made to produce a nearly constant electric pressure when driven at a variable speed by the car axle. The speed of the dynamo armature must not, however, vary outside of certain limits or the automatic regulation of pressure cannot be maintained. The dynamo to be driven from the car axle is usually placed in or under the baggage car, and the necessary mechanical connections made.

It is at once evident that when a dynamo is driven from the car axle, not only must the locomotive remain connected with the train, but it must also remain in motion so long as light is to be had, unless a storage battery is provided. As it would never do to have electric lamps go out every time the train stops, a storage battery is usually provided when the power for dynamo is taken from the car axle. The battery may be all together in the baggage car, but the ideal place for it is under each car, in sections. A third method of lighting railway cars is that entirely with storage batteries. The batteries are usually charged at terminal points for all-night runs and are carried in suitable compartments beneath each car. This last arrangement makes each car independent of the train or locomotive, as to light.

So far as the quality of service is concerned, train lighting with storage batteries is ideal, but the first cost of batteries is comparatively high, the shake and jar of travel hastens their deterioration, and their weight has to be considered. The total weight of battery necessary per car is, of course, much greater when they are used alone than when in conjunction with a dynamo on the train. When used with a dynamo on the train, the capacity of the battery need be only sufficient to operate the car lamps during times when the dynamo cannot be used, say for not more than one hour per night, or at any one charge. When, however, the battery is used alone, it must have capacity for an entire night, or say ten hours, and will, therefore, be much heavier, since weight increases directly with the capacity. The first cost and rapid depreciation of storage batteries, together with their expense of operation are such that their general and exclusive adoption in the lighting of railway trains seem very doubtful. If electric lights are to come into common use on cars drawn by the steam locomotive, they will probably be supplied from dynamos carried on the trains and supplemented by a small storage battery on each car.

In first-class train service the system of lighting by compressed gas is no doubt more generally used than any other at this time. The compressed gas is carried beneath each car in steel tanks, and flows to the burners under the tank pressure, which, of course, decreases as the gas is used. A supply of gas being thus carried with the train, it is pertinent to inquire whether means exist by which more light can be had per cubic foot of gas than is now obtained from the burners. Instead of consuming gas at the burners it may be used in a gas engine and the power thus developed, expended to drive a dynamo. A good coal-gas, of about 600 heat units per cubic foot, will yield one brake horse power hour for each twenty cubic feet of gas consumed in the cylinder of a modern gas engine. This brake horse power hour represents 746 watt hours applied to the armature shaft, and allowing the low average efficiencies of 85 per cent for the dynamo and 95 per cent for the line and connections, the lamps will receive $746 \times .95 \times .85 = 600$ watt hours for every cubic foot of gas consumed by the engine.

Incandescent lamps of nominal sixteen-candle power are now largely used, that require but fifty watts each, and twelve of these lamps may obviously be maintained per hour for each cubic foot of gas burned in the engine. Even if an incandescent lamp that requires sixty watts is used, ten may be operated per hour for each cubic foot of gas consumed. Incandescent lamps of other candle powers can be had at about the same efficiency as that just stated, the watts per candle increasing slightly in very small lamps and decreasing for very large ones. The candle power of gases vary somewhat, but four to five cubic feet of good coal gas, at the burner per hour, are commonly considered about the equal of one sixteen-candle incandescent lamp. On the basis of five cubic feet of gas per hour, twenty cubic feet supply but four burners, and with only four cubic feet the burners maintained per hour is only five. As ten to twelve sixteen-candle incandescent lamps are maintained per hour, per twenty cubic feet of gas expended at the engine, from two to three times the amount of illumination can be obtained when the gas is exploded in the engine cylinder that is given off by the same quantity when consumed at the burners. This difference in operative efficiency is more than enough to offset the higher first cost of the electric equipment. The best location for the gas engine and its driven dynamo is probably in the baggage car, and this would bring the gas reservoirs to the same point. Power for the electric light is then independent of both the motion of the train and the presence of the locomotive, but if storage batteries are not used on each car, light can only be had so long as the baggage car is connected with the train. The cost of sufficient batteries on each car to supplement the service from the dynamo, being charged by it and used only when the baggage car is disconnected, is not large, and their use makes the system ideal in service as in cost of operation.

AIR PIPES FOR MINES, MADE OF CLOTH.

A Dusseldorf firm is making cloth air pipes for mines. They are made of strong sail cloth impregnated with India rubber so that they are both air and water tight. They are much cheaper and lighter than those made of zinc and wood and they can be easily transported and secured. The galvanized iron rings are provided with the pipes. They are spaced at certain distances for suspension. Steel rings are also inserted at places and prevent the pipes from kinking. Several hundred feet can be put up in a few minutes and the transportation of the pipes around the mine is easy. One great advantage is, according to The Colliery Guardian, that when shots have to be fired the cloth pipes can be folded together and put out of the way, whereas zinc pipes are not easily removable and if they are left would be much damaged.

"HALL I' TH' WOOD," BOLTON.

Mr. W. H. Lever has presented "Hall i' th' Wood" to Bolton, England, together with the sum of $6,000 for its maintenance. It was the home during some years of Samuel Crompton whose father rented here two or three rooms of the house, and who devoted five years from 1774 to 1779 in secret to the invention of the spinning mule, a machine which was long known as the "Hall i' th' Wood wheels." This machine was sold to a body of eighty manufacturers for $300, about 1785. The woods around it have long since been cut down, says The Builder from which we obtain our information.

THE FATHER OF PHOTOGRAPHY.

February 11 was the one hundredth anniversary of the birth of Henry Fox Talbot, for whom is claimed by many the place which has long been held by Daguerre in the estimation of the world. Those in favor of the claim say that Fox Talbot deserves this position because by his public announcement of a successful photographic process he anticipated Daguerre by some months, and secondly, present day photography is a direct descendent and modification of the Fox Talbot method, and has no connection with that of Daguerre which process is now archaic. Daguerre has many public memorials both in France, England and America, but Fox Talbot, who died in 1877, has never been honored. A committee has been formed at his own home, Lacock Abbey, near Chippenham, England, to raise a memorial fund for the restoration of the chancel of Lacock Church. As he was lay rector of the church this seems to be a memorial which he would have de-

sired most. A small edition of prints from three of Talbot's photogravings on copper have been made and published, the money received from purchasers of these will be handed over to the fund without any deduction of expenses.

TURPENTINE AND ROSIN.

BY C. K. HAWKINS.

The manufacture of spirits or oil of turpentine, and rosin has been for many years the principal industry of the entire part of the Southern States known as the long leaf pine belt, and the business of "yarding" and shipping of these and other naval stores has been and is now the basis of the prosperity of many of the cities on the South Atlantic and Gulf Coast.

Both spirits of turpentine and the solid product known as rosin are obtained from the exuded gum or resin of various members of the yellow pine family, but principally of the variety Pinus Palustris, or "long leaf" yellow pine.

The resin which is of a semisolid consistency and whitish in color, is insoluble in water, but readily soluble in ether or spirits of turpentine. It is obtained from the tree by boxing, or cutting a deep notch in the trunk, about a foot from the ground. These "boxes" hold about a quart, their number is limited by the diameter of the tree, the usual rule being to leave 12 inches of bark between each box, this giving two to four and sometimes six boxes to each tree, the box being 10 to 12 inches across the opening. Ten thousand boxes constitute one working unit or "crop," requiring from 100 to 200 acres in the new regions along the Gulf Coast, and from 500 to 1,600 in the "worked-out" districts of North Carolina.

The boxes are cut with an axe having a very long and narrow blade, and short and heavy handle. This is done during the winter months, when other work on the turpentine farm is at a standstill. Upon the opening of the warm weather, which causes a flow of sap into the boxes, the trees are "chipped" or scarified, by removing the bark and wood to a depth of about an inch just above the box. This operation is repeated every week during the season, each "chipping" exposing about an inch and a half further up the tree, but maintaining the same depth. The tool used is called a "hack."

The gum exudes from the scarified surface and flows down into the box, whence it is collected every four weeks by means of a "dipper" which is simply a flat pear-shaped blade, and sets into a handle. The average weight of a barrel of "crude" is 240 pounds, and a crop of first-year or "virgin" boxes should yield 35 to 50 barrels at each dipping, or 245 to 350 barrels during the season, decreasing to 12 or 16 barrels per dipping during the fourth year, at the end of which the farm is usually abandoned and turned over to the timber men, although some of the smaller landowners in the older districts, especially in North and South Carolina, work their trees as long as they can get anything out of them.

The stills usually hold from 10 to 50 barrels of crude, and are made of copper. The kettle, which is in a brick setting with furnace underneath, has an opening near the bottom with a gate faucet, out of which to run the charge after distillation.

A little water is run in when the still is charged, and heat applied gently at first, being gradually increased until the whole mass reaches the boiling point, where it is maintained during the remainder of the process. The steam produced by the evaporation of the water passes over into the worm, bringing the turpentine in a vaporized form with it, and being condensed, runs off into a vessel placed to receive it, in which the water settles to the bottom, and the turpentine, being of a less specific gravity, collects on the surface and is dipped off into barrels. Water is constantly added to assist in the vaporization and to prevent burning of the charge. With a glass the distiller notes the proportion of spirits and water coming over, and when the spirits has decreased to about one-tenth of the whole the distillation is stopped and the remainder of the charge is run out into a wooden trough, passing first through a strainer of No. 6 mesh, next through one of about No. 40, and last through a No. 80 mesh. While still hot is is dipped up into barrels.

The number of charges per day which can be run in a still of ordinary capacity is from two to five, depending on the character of the crude and the time of distillation.

A charge of twelve barrels of crude gum should yield 120 to 130 gallons spirits and seven or eight barrels of rosin.

Spirits of turpentine fresh from the still is perfectly clear and transparent, with a faint, pleasant, aromatic odor, and is very different from the ill-smelling, yellowish liquid that we usually see in paint stores.

The spirit barrels are prepared by being coated on the inside with glue, which being insoluble in turpentine renders them impervious to the action of the liquid and prevents leakage.

There are fifteen recognized grades of rosin, those known as W. G. (window glass) and W. W. (water white) being the finest and most valuable, and from N, which is very clear, the grades run through M, L, K, J, H, etc., to A, which is almost black. Of these the W.W. and W. G. grades are produced from the "virgin dip," or first year's run, each subsequent year's run producing a poorer grade.

During the latter part of the season, as the weather becomes cooler and the flow of sap diminishes, the gum forms on the boxed face in a hard white mass, greatly resembling honeycomb. The scraping off and distilling of this is the last operation of the season. This scrape which amounts to from seventy barrels per crop the first year to 100 barrels in the fourth, produces rosin of an inferior grade and but little turpentine.

The next important step is the shipping of the finished product. The stills are usually situated at a considerable distance from transportation, and most of the larger operators either build tram-roads to reach the shipping point, or else make use of those built by the sawmill people. The rosin which is shipped in very rough barrels, made at the still, and holding 350 or 400 pounds is, upon its receipt by the factors at the seaport, first weighed, then graded, and after reheading, is stored in open yards, to be presently loaded upon vessels for export. The vessels usually employed in the foreign trade are Norwegian and Swedish barks, of a tonnage varying from 500 to 1,100 tons.

The spirits receive a rather different treatment, being run from the cars under open sheds, and the barrels emptied and reglued, if necessary. The spirits is then rebarreled, if destined for export, or run into tank cars, if for shipment to the interior.

A shipload of spirits when the price is ruling between 30 and 40 cents per gallon is rather more valuable than the average reader would at first suppose.

By far the largest amount of rosin produced is consumed in the manufacture of soaps and varnishes, of which it is an important constituent. A great deal of it is redistilled for rosin oil, which is used as a basis for various grades of machine oils, and in the manufacture of wagon grease, printing inks, and lacquers.

Spirits of turpentine is used in the manufacture of varnishes and paints, and to some extent in chemical operations and medicine.

OUR RAPIDLY GROWING IRRIGATION AREAS.

The United States Department of Agriculture has issued a bulletin regarding irrigation in the Rocky Mountain States, by J. C. Ulrich an irrigation engineer, of Denver, Colo., describing the agricultural conditions of the Rocky Mountain region, covering more particularly the States of Colorado, Idaho, Montana, Utah, and Wyoming. How ditches are built, rights to water established, and the water diverted into canals and ditches and applied to the land, as well as the climate, resources, and general character of the region, are well covered, the main purpose being to instruct those to whom the subject is new and enable them to avoid the costly mistakes which novices are liable to make. The difference between ditches belonging to individuals, corporations, or districts are outlined as well as the methods of operation. Of the latter Mr. Ulrich says:

"The owner of an individual ditch operates it as he pleases, subject only to the State laws governing the diversion and use of water. But when several persons are interested in the same ditch the necessity for some system of control arises. In the case of unincorporated community canals, this control is secured by the selection of a water-master, who is usually one of the owners, to have charge of the operation and maintenance of the system and the distribution of its water to those entitled to its use. It is on the large corporation canals, however, that the necessity for a careful system of operation and management is most apparent. Many of these canals are more than 50 miles long and number their water-users by hundreds. The Ridenbaugh Canal in the Boise Valley, Idaho, furnishes water to more than 500 farmers. The High Line Canal in Colorado has 433 consumers under it; the Loveland and Greeley has 257, and many other systems are as large or larger. . . . It can thus be readily seen that the proper operation of such canals involves a very thorough business organization and careful attention to many important details."

The flooding, furrow, and compartment systems of applying the water to the land are described, and their special conditions and applications are setforth. The value of reservoirs in equalizing the supply from streams and in enlarging the watered area is pointed out. Of this the author says:

"The quantity of water necessary or used for irrigation fluctuates during the irrigating season, but unfortunately the period of maximum use does not coincide with the period of maximum flow of the streams. . . . The time of greatest need for water varies somewhat in different localities, but generally there is very little water used in April, and the quantity used in May is relatively unimportant. June and July are the months of maximum use, and the use in August is usually considerably greater than that in May. . . . The August flow of streams is that which limits their irrigating capacity. Not more than about 20 per cent to the total annual discharge of streams can be made available for irrigation from their natural flow. . . . Where the topography of the country is favorable this loss of water may be prevented or greatly diminished through the construction of reservoirs for storing the surplus during the early part of the season for use in the later months. . . . With these benefits there are also complications. If a comprehenisve system of storage is to be adopted it will doubtless increase the difficulty of dividing water among the different claimants to a common supply and make it necessary to have additional legislation to define the character of the rights to these stored waters."

In an appendix, Mr. Ulrich describes the methods by which the various States divide water among appropriators and gives the names of officials in charge. One gathers that there is now pressing need for National legislation to control the whole subject of water storage and supply, where more than one State is involved in the same system, as is not frequently the case.

E. M. A.

NEW STEAMSHIPS BUILDING.

In many respects a new era of steamship building is in progress, both abroad and in this country, and the recent withdrawal from commerce of the large fleet of steamers to carry British soldiers to South Africa seems to demonstrate the inadequacy of the present vessels for the ocean-carrying trade in emergencies that may at any time arrive. Not only was our Pacific Coast trade hampered by the withdrawal of steamers for duty in the Philippines, but the passenger service to the Paris Exposition next summer will be more or less seriously affected by the lack of ships. There will be few if any steamers that can be chartered for carrying the extra crowds, and some of the regular liners will probably be out of commission. Six of the Cunard line's steamers are employed by the British government, including some of the most commodious vessels engaged in transatlantic service, and three of the White Star steamers, including the big "Majestic." These vessels will hardly be returned to the companies in time to participate in the active ocean traffic for the Paris Exposition.

There will be several new ocean liners finished by spring which will partly compensate for the loss of these big steamers of the English companies. The Holland-American line expects to have ready for the spring rush to Europe the new "Potsdam," a liner of large dimensions and superb accommodations. The French line will launch three new steamers equal in capacity and service to any engaged by that company in transatlantic service. These vessels, "La Savoie," "La Lorraine" and "l'Aquitaine," will form quite a formidable little fleet by themselves, and they will add greatly to the carrying capacity of the French line.

There is building in this country quite a formidable fleet of steamers which will be completed at different times within the next year or two. The Pacific Coast will monopolize many of these new American coasters, and they are being built for trade on that side of the world. The Pacific Mail Steamship Company will soon launch two fine steamers for Oriental commerce to ply between San Francisco and China and the Philippines. The Oceanic Steamship Company has three steamers under way, and the International Steamship Company is having two commodious vessels constructed. There are four new steamers being built for the Hawaiian trade with a gross tonnage of 26,590. The New York and Cuba Mail Steamship Company have three more vessels partly finished.

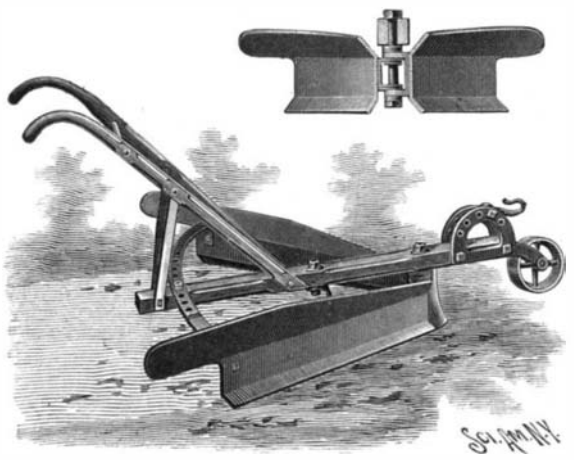
The majority of the new steamers are being built on the Pacific Coast, and indicate the prosperity that will follow our new policy in the Far East. President Hill, of the Great Northern Railroad, promises that within five years there will be twenty-five new steamships in the Oriental trade, plying between the Pacific Coast and China, Japan, and the Philippines. These, he predicts, will be of the largest size, with enormous carrying capacity, and slow of speed. Speed is not considered so much an object as to be able to lay the goods down on the other side of the Pacific so that they can compete with the native product.

The shipbuilding yards of both coasts are reported to be full of orders, and even those on the Great Lakes have all they can reasonably construct in the next year. According to the Commissioner of Navigation there are 50 war vessels, with a total displacement of 140,813 tons, under construction or contract in this country, and 45 coasting vessels besides the large ones mentioned above with a total gross tonnage of 76,007. The construction of these vessels assist in promoting the new era of prosperity in American shipbuilding. The world's carrying trade has in recent years increased faster than the number of steamers built to transport it, and the peculiar conditions brought about by war have merely tended to emphasize this fact and bring the matter to an acute crisis. In the new shipbuilding era we shall no longer stand by and permit other nations to do most of the building; for the signs are unmistakable that the long-looked for and urgently-needed revival of American shipbuilding is at hand.

AN EFFICIENT CORN AND POTATO HILLER.

Our illustrations picture a new implement for hilling corn and potatoes in which the mold boards can be adjusted relatively to the advance share so as to insure the banking of the soil close to the rows of plants at each side of the furrow. The hiller has been patented by Van Allen Whitbeck, of Aquetuck, N. Y.

To the underside of the beam a bracket is secured, at the forward end of which a share is carried, extending up into engagement with the beam. A pivot-pin passes through the beam, the bottom portion of the bracket behind the share, and the overlapping projections of the mold-boards. These mold-boards are straight and



A NEW FORM OF CORN AND POTATO HILLER.

in all positions are within the line of the side edges of the share so that the earth turned up by the share passes freely to the outer faces of the mold-boards. The mold-boards are provided with extensions on their rear ends, from which extensions apertured segmental arms project laterally. These arms are designed to slide one over the other, and are held in adjusted position by means of a bolt passing through registering apertures. By this means the hiller can be adjusted to any desired width. The peculiar formation of the mold-boards insures the earth's being carried up close to the roots of the plants, and deposited on the upper portions of the rows. The lower part of each mold-board serves to cut weeds; the upper part throws rising earth downward; and the straight body sections conduct the earth directly to the plant stems.

The inventor informs us that by mounting the hiller on a runner and raising the colter-wheel a very efficient snowplow is formed which runs with remarkable steadiness.

A BICYCLE MOTOR EQUIPMENT.

How a bicycle can be transformed into a self-propelling machine by the addition of a small motor and the few other essential parts is shown in the annexed illustrations. It forms one of the simplest and most compact automobiles imaginable, and will doubtless be very useful to riders of ordinary endurance, who wish to increase their riding radius, easily ascend hills, or make long trips on the flying steed.

A reference to the larger illustration will show the reader at a glance the details of the driving mechanism. This consists of the small, water-jacketed motor, 3, having on one side the flywheel, 11, and on the other a small sprocket, which is connected to the large auxiliary driving-sprocket on the back wheel by a chain passing over a sprocket guide-wheel supported upon the bicycle frame. The tank, 1, contains the gasolene, while in the box, 2, is placed the ignition battery. This is connected by flexible cord to the igniter of the motor and to a push button, 6, located under one of the handles of the handle-bar. The motor is lubricated from the oil cup, 10, and is cooled by water from the tank, 7, placed under the seat which circulates through the pipes, 8, to and from the water jacket. The tube, 9, is a muffler and is said to be very effective.

In starting the machine, the compression lever, 4, is released, then the rider mounts and drives ahead by giving the pedals two or three revolutions in the ordinary way. He immediately throws on the compression lever, 4, and presses the button, 6, whereupon the motor starts and drives the machine at a good rate of speed. The speed may be regulated by moving the wire hook, 5, which controls the air mixture while the bicycle can be quickly and effectually stopped by simply ceasing to press the igniter circuit button, which will cause the compression of the unexploded charges to powerfully brake the motor.

The smaller illustration shows the appearance of the machine when the parts are all incased. When viewed from the front, the remarkable compactness of the equipment is evident from the fact that the width of the casing is no greater than the width of the front fork. The entire weight of the motor addition is only about 25 pounds, and a pint of gasolene is sufficient to drive the bicycle over twenty miles.

This motor attachment is the invention of Mr. Steffey, a mechanic, of San Diego, Cal., and we understand a company has recently been formed under his name for the manufacture of the entire equipment.

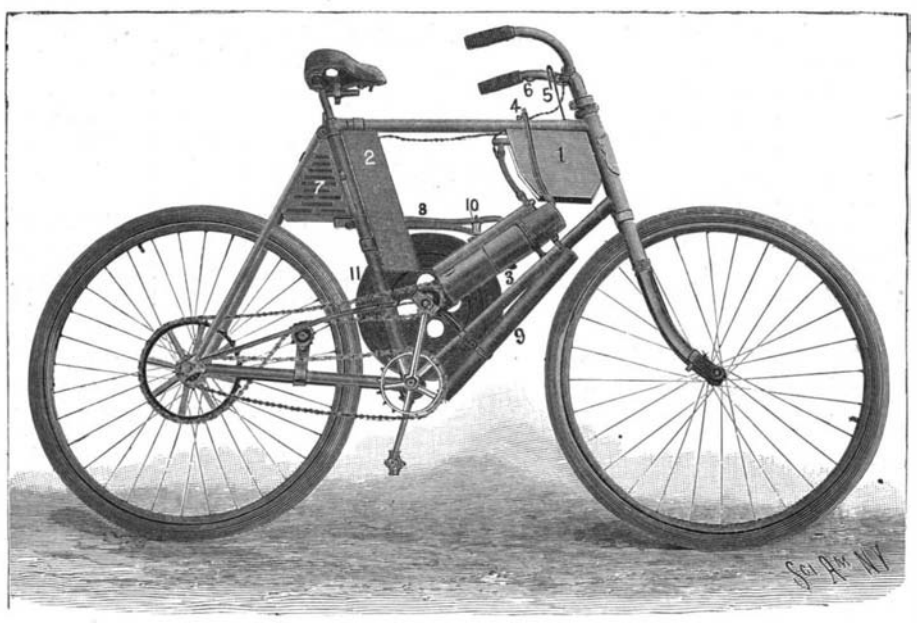
A Victim of the Bubonic Plague.

A well-printed, illustrated weekly newspaper comes to us from Honolulu, Hawaii—Austin's Hawaiian Weekly. The last number received contains an account of the black plague which prevails at present on that island. The following graphic account of a single case indicates the nature of that direful disease, of which little is known in this part of our country.

The death of a Japanese woman on Maunakea Street last week was an event of more than passing notice. She was stricken with the malady at eleven o'clock in the morning, while performing her household duties, the first symptoms being a sudden rise of pulse with the accompanying fever. She called her husband and told him she must lie down as she felt weak and exhausted. She reclined on a pallet, which was about the only article of furniture in the shanty where they were living, and attempted to go to sleep, but a sensation of strange pains dispelled all thoughts of rest and she asked her husband to come to her bedside. She could only murmur: "Don't call the doctor; ask Ito to come." Ito, who was her sister living a few doors away, was speedily brought, and she proceeded to act as nurse. The contact of the black plague is like that of a ravenous tiger—short and fierce. In a little while the poor woman was groaning with pain and throwing herself from side to side in a vain endeavor to get relief. Ito procured ice and applied cooling cloths to her temples, but the fever had gained a headway that baffled nursing. The disease was a complete master of the patient, and the swellings that characterize the bubonic plague began to appear in just an hour after the first symptoms asserted themselves. It was noon when the miserable victim was suffering indescribable torture. Shrieking and imploring her husband to kill her, she writhed on her bed of agony. Ito then prepared poultices and applied them to the nauseous protuberances that had appeared over the groins and under the arms. At one o'clock the woman gave up her life and added another unit to the list of Honolulu's plague-stricken victims.

THE southern hemisphere has been visited by intense heat. A few days ago the thermometer registered 120° F. in the shade, nearly all day at Buenos Ayres, says The Medical Record. There were 102 cases of sunstroke, of which 93 were fatal, and the next day there were 219 cases, of which 134 were fatal. The weather has also been extremely hot at Melbourne, and in South Africa the British troops have suffered exceedingly from the almost unbearably high temperature. Indeed, the whole world seems to be warmer than usual, for the winter in this country has been far from severe, and in the Klondike the weather is almost mild, and even at the health resorts at Switzerland, Davos Platz, the season has been ruined by warm weather turning the snow into slush, which has resulted in keeping all of the invalids in the house.

THE STEFFEY MOTOR CYCLE.

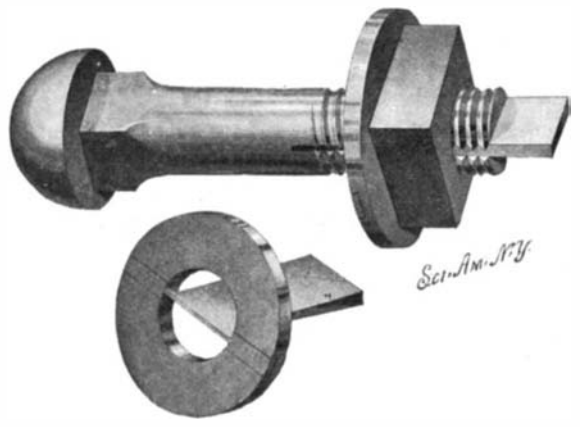


MOTOR ATTACHMENT FOR BICYCLES.

A NEW NUT-LOCK.

To provide a lock which will securely hold a nut in position and prevent its displacement by vibration is the object of an invention recently patented by Robert L. Bargelt, of Woodstock, Va. Fig. 1 is a perspective view of a bolt with a nut locked in place. Fig. 2 is a perspective view of a combined washer and wedge.

The bolt, as shown in Fig. 1, is formed with a longitudinal slot in its threaded end, by which slot the wedge is designed to be received. On its face the



A COMBINED LOCKING WASHER AND WEDGE FOR NUTS.

washer is provided with two alined recesses in which the laterally extending arms of a wedge are engaged. The washer and wedge are slipped over the bolt, with the wedge in the slot of the bolt. The nut as it is turned on the thread, draws the wedge into the slot, thereby expanding the outer end of the bolt and increasing its diameter. When the bolt is used in positions where it is not subjected to the action of rust, the nut can readily be removed by sharply striking the wedge laterally. When the bolt is used underground, as in the laying of street railways, the metal is quickly coated with rust, and the usual procedure of breaking the nut loose from the bolt must be resorted to.

The action of the locking-wedge is in effect that of a rivet. The great merit of this nut-lock resides in the impossibility of loosening the nut by means of a wrench, when used on a railway fish-plate. The cost of the manufacture of the washer and wedge is small; for the parts can be stamped out of suitable materials very cheaply.

A Comparison of Automobiles.

In a recent lecture on "The Development of the Automobile," before the Electrical Engineering Section of the American Institute, Mr. R. E. Fless stated that the automobile of to-day was divided into three classes, those propelled by steam, electricity and petroleum. Each class has good points. The best record for speed is credited to the electric style, which has made a speed for a short distance of sixty-three miles an hour.

As a matter of record, the electric machine has proved to be best for city streets and over level roads; for short distances the petroleum or gasoline motor is best for ordinary runs in the country where there is some uneven ground to be covered; while steam is the choice where heavy work is to be done.

The automobile first came into prominence in France in 1894, during which year the first race was run. England became interested two years later, and the following year (1897) the "auto" was introduced in this country. Since that time it has made great strides.

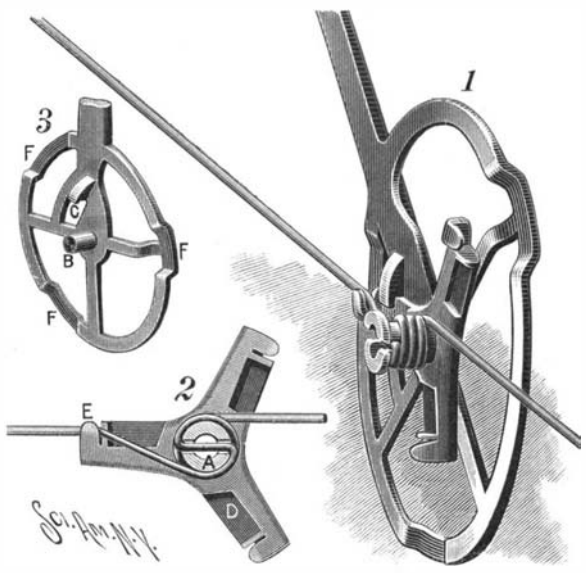
The interest reached its zenith last year in both Europe and America. There are 7,000 owners of horseless vehicles in Europe to-day, 5,000 of whom are in France. In Paris alone there are 600 manufacturers and more than 900 dealers. In this country it is not so far advanced, although popular interest is increasing.

The lecturer enumerated among the advantages of automobiles that they occupy less space in front of a store in the shopping districts, and give more reliable service in heavy weather than can be attained in any other way.

THE Paris Exposition will have the largest theater in the world, accommodating 12,000 to 15,000 persons. It is to be erected within the "Galerie des Machines." The auditorium will consist of five tiers. The stage is to be circular and capable in parts of being moved round on a turntable which will alone measure 300 feet in diameter. It will be largely used for spectacular performances.

AN IMPROVED WIRE-STRETCHER.

A new wire-stretcher has been patented by William E. Kimmel, Bermudian, Penn., which is designed to take up the slack in wires stretched between fence posts. Fig. 1 is a perspective view of the complete device. Fig. 2 shows a capstan employed. Fig. 3 is a perspective view of an operating-lever. The stretcher comprises essentially two pieces, the capstan and the operating-lever. The capstan is formed with a tubular portion, *A*, provided with diametrically opposite slots to receive the wire and flanged to prevent the wire's slipping. Arms extend radially from the tubular portion, *A*. Each arm has a recess, *D*, at one side and a hook, *E*, on its outer end to retain the wire. The operating-lever consists of a handle and a ring-shaped head having a hub, *B*, at its center designed to engage the tubular portion, *A*, of the capstan. The ring is formed with depressed portions, *F*, not in the same plane as the arms of the capstan, so that the wire will be clear of the head portion after the stretching is effected. The lever-head carries a lug, *C*, designed to engage the capstan arms when the lever is turned. The lug is curved to permit its gliding beneath an arm upon a backward motion of the lever. The wire to be stretched is placed in the slots of the tubular portion, *A*; and the hub, *B*, of the lever head is fitted in the tubular portion of the capstan. The entire device is then turned as the lug, *C*, engages one of the recesses, *D*, of the capstan arms. The lever is moved as far as possible and is then brought back to engage the lug with the next arm, whereupon the capstan is again turned. When the slack has been taken up, the lever is slipped off, leaving the capstan permanently in position to retain the wire as shown in Fig. 2.



TIGHTENING A SLACK WIRE.

THE SNOWFALL AND WATER SUPPLY OF THE ROCKY MOUNTAINS.

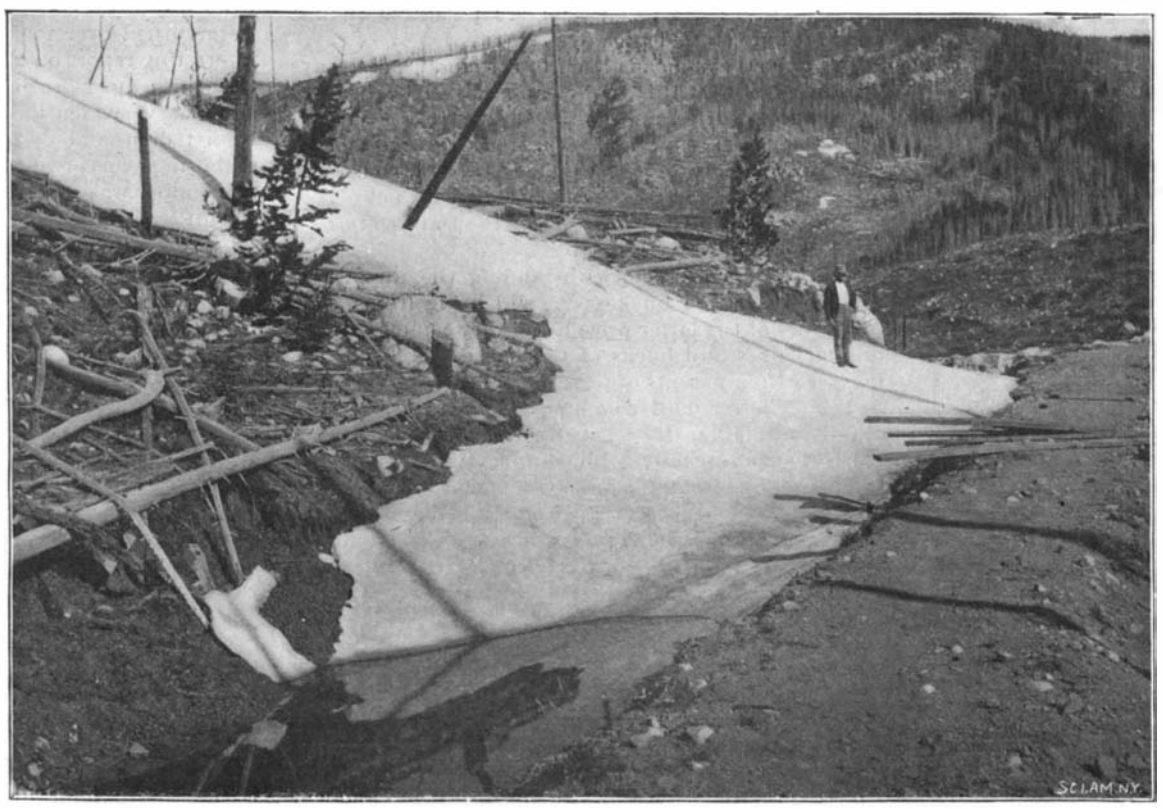
BY H. A. CRAFTS.

While the mountain gorges of the higher altitudes of the Rocky Mountains contain large bodies of perennial snow, there is supposed to be but one real glacier in Colorado. This is Hallett's Glacier, which is situated upon Hague's Peak in the northern part of the State, between Estes Park and Middle Park. It was discovered only a few years ago by a Denver man, after whom it was named. It is of comparatively small extent, but it has been examined sufficiently to convince scientific men that it has existed for many generations. The innumerable bodies of snow which last from year to year, upon being thoroughly explored prove to be snow only, though their lower strata have become considerably compacted, with an admixture now and then of ice. But they are far from having arrived at the glacial state. The fresh layers of snow that are deposited from winter to winter upon their surfaces melt almost entirely away each summer, under the combined influence of sun and wind. The almost entire absence of glaciers however is accounted for, by those who have studied the subject, by the extreme aridity of the climate. If heavy and continued rains prevailed during the warm season of the year, these great beds of snow would be converted into water, and the water into ice, which would be found gathered in great masses in the mountain gorges. There are marked evidences, however, among the Rocky Mountains of Colorado that at some remote period real glaciers did exist. In the opinion of Prof. L. G. Carpenter, of the department of irrigation engineering of the Colorado State Agricultural College, an immense glacier once existed on the eastern slope of Mt. Cameron of the Medicine Bow Range in Northern Colorado. There is strong evidence that Chambers Lake, which lies just under the southern slope of Mt. Cameron, at some former age emptied into the Big Laramie River instead of the Cache la Poudre as it does now; for the great earth dike that now forms the eastern bank of the lake is composed almost entirely of loose earth and broken rock, being entirely different in character from the composition of the surrounding barriers; yet this theory is somewhat weakened by the absence of moraines in the neighborhood. The supposition is, however, that an immense glacier at some former period slid down from the side of Mt. Cameron, dammed up the original outlet of the lake, and turned the overflow of the lake into the channel of the Cache la Poudre.

Over in Estes Park, some twenty-five miles south of Mt. Cameron, are found not a few well-defined moraines, a further proof that these mountains once contained genuine glacial formations of no mean magnitude, for the moraines indicate violent convulsions of nature. It may also be stated that the flat grounds in the valley of the Joe Wright Creek, near Cameron Pass, some six miles south of Chambers Lake, have a peculiarly billowy formation, as if the ridges and knolls had been formed from the residuum of glacial decay. These evidences of glacial formations, however, imply the existence of very different climatic conditions from those now prevailing. The climate must have been warmer and characterized by heavy rainfalls, otherwise the heavy ice masses could not have been formed. Now, nearly all of the precipitation in these high altitudes is in the shape of light snow. In fact, snow falls in every month of the year. The rain which falls during the summer months usually comes in heavy showers or "cloud bursts" as they are called in Colorado, causing sudden floods in the mountain streams. The snows that fall during the winter are rapidly melted by the bright sunshine and warm winds of springtime, and also cause very high water in the streams. To show the great fluctuation in the flow of some of these streams, it may be stated that at the height of the flood season of 1884, which followed a period of copious snowfalls in the mountains, the Cache la Poudre River carried as high as 7,000 cubic feet of water per second, while in 1898 at low water and after a period of light snowfalls it ran down to only about 30 cubic feet per second. This shows how much the mountain streams of Colorado are dependent upon the snows for their water supply, and how quickly and powerfully the snow supply is acted upon by the sun and air of this arid climate.

It will be seen that these conditions have an important bearing upon the subject of irrigation, upon which Colorado depends almost exclusively for her agriculture. The rainfall of Colorado is merely supplementary to her supply of water available for irrigation. The question that interests the farmer more than anything else is the amount of snowfall in the mountains. Of so much interest is it that information bearing upon the amount of snowfall from month to month during the winter time is sought from many points, and from bulletins in the local newspapers. The relation of forestation to the snowfall and its preservation also engrosses the attention of the agricultural economists. The setting aside of the Medicine Bow forest reservation recently by the general government was due to the efforts of certain farmers of Northern Colorado, the purpose being to preserve the forests as a shelter for the snows falling in the timber belts, and thereby prevent their too sudden melting and a consequent waste of water by excessive floods. This reservation extends northward from the vicinity of Estes Park some hundred and twenty miles, and is about forty miles in width, including the great timber bodies of the Medicine Bow Range, in which head the Little and Big Thompson Creeks, the Cache la Poudre, Big Laramie and North Platte Rivers. But it is not the timber cutter so much as the forest fire that destroys these forests. Every precaution is taken by both county, State, and government authorities to prevent these fires, but the territory is so enormous over which these timber tracts extend that it is well nigh impossible to prevent fires altogether. Each summer the mountains swarm with outing parties, and a lighted match carelessly thrown on the ground, or an unextinguished camp fire, may start a conflagration that may spread over large tracts of fine timber and leave nothing in its track but blackened earth and charred trunks.

One of our illustrations showing a snow drift filling a section of the Big Laramie ditch, recently described in the SCIENTIFIC AMERICAN, not only shows the large bodies of snow remaining in this region as late as June 25 of the year 1899, after our unusually copious snowfall of the winter before, but also gives a fair idea of the denuded state of the mountains in the vicinity, by reason of forest fires. On the slope above the ditch may be seen the dead trunks of trees lying about in wild confusion, while here and there may be seen a sapling pine, bravely struggling to supply a part of a once noble forest. The hillside in the background also gives some idea of the frightful ravages of forest fires in the Rocky Mountains. There is a bare remnant of a once dense growth of tall pines, the main body being supplanted by a meager sprinkling of aspen trees. Very slowly indeed are these ruined forests being replaced by a new growth. And here appears to be another proof of the changed climatic conditions. On northern slopes, where the sun's rays descend with less power, and the snows are not so quickly melted away, the tree growth is more vigorous, but on the southern slopes it seems almost impossible for trees of any kind to make headway against an unfavorable soil and climate. Prof. Carpenter recently made some investigations as to tree growth in Estes Park, at an altitude of about 9,000 feet above sea level. He found in one instance that it had taken thirty-two years to make a pine tree twenty feet high and four inches through at the butt, and twenty years to make a tree twelve to fifteen feet high and two inches thick at the butt. At an altitude of 11,500 feet he found an aspen twig about as large as a man's thumb and a foot high that showed twelve rings.



SNOW BANK FILLING BIG LARAMIE DITCH, JUNE 25, 1899—ALTITUDE, 10,000 FEET.

While this destruction of forests has made no perceptible difference in the amount of precipitation, it has made a marked difference in the flow of water in the mountain streams. Instead of the snow beds being protected from the sun's rays by a dense shield of pine boughs, and thus melting slowly and giving a steady and extended flow of water, they melt with great rapidity upon the arrival of spring and fill the mountain streams with roaring torrents whose volume cannot be properly and economically controlled by the present ditch and reservoir facilities.

MR. E. H. HARRIMAN, the patron of the Harriman Alaska expedition will publish the results of the explorations in a series of several volumes prepared under the general editorial management of Dr. C. Hart Merriam. The first volume will be a narrative of the expedition by John Burroughs, with chapters on glaciers by John Muir and other chapters by well-known writers.

The Durability and Preservation of Paintings.

A picture is one of the most precious of human documents, and at the present time artists are producing paintings which are changing—changing so rapidly in some cases that the beauty fades even before they leave the studio, and in a few years there will be hardly a trace of their original beauty. The treatment of pictures after they have passed from the artist's care is frequently one that tends to their destruction. The durability of a picture should be a point of honor with an artist. The permanency of ancient works of art is well illustrated by the fact that some madders are still quite vivid, and the same may be said of vermilion, while the high reds have changed only slightly. The red draperies of the Italian pictures as early as Fra Angelico, painted with rose madder, are perfect at the present time, and the Dutch and Flemish schools exhibit many very excellent examples of the most durable work. At the same time we find many failures—for example, patches of black occur in drawings by old artists where high lights were, and they had no permanent true yellow or orange pigment, the yellow used by older artists being fugitive. The yellows of arsenic have not only gone themselves, but have also injured the colors they came in contact with, while the orange hues produced from the same substance have turned dark brown, and in some cases black. In more recent times, in some of the works of Cox and Turner, there is noticeable a faded and changed condition.

In the past the young artist was apprenticed to an older artist, preparing all the materials and grinding the pigments to be used in the production of the picture, consequently the artist knew exactly the quality of the colors he was using and was not at the mercy of the color manufacturers. At Antwerp, there is a trunk which belonged to Rubens, in which he had placed pigments collected during his travels, showing what care he took in selecting his colors. The atmosphere of our city since the introduction of coal as a fuel is most detrimental to painting, fresco being well nigh impossible with the air full of smoke particles and sulphur compounds from the combustion of coal. If modern chemistry has produced many fugitive colors, it has also added very largely to the list of permanent ones. The English Architectural Review, from which we obtain our information, gives most interesting facts relating to the "Durability and Preservation of Paintings," written by James Leicester, F.I.C., F.C.S. The whole of a man's life work, the visible and surviving records of our great painters, are dependent upon a few tubes of colors; and when we consider the vast sums of money given for great works at the present time, it is only honest that they should be produced of good and durable materials, and artists should look to the future stability of their work as do architects. The preparation of colors too quickly and without sufficient washing, and in some cases the mixture of cheap and bright pigments with dull ones, should be condemned. There are many easy tests by which artists can detect impurities in their pigments, but they are not apt to go to this trouble, nor have they the requisite experience to test them, and they are too apt to be governed by the colormaker's word. The artist should demand, says Mr. Leicester, the chemical formula for each tube sold, or in other words, the true name of the ingredients.

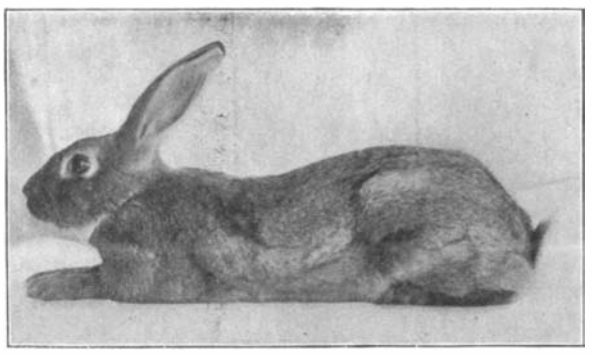
The scheme of M. Vibert, that painter of splendid genre, is well worthy of consideration. He proposed that a permanent commission on the material processes of art be appointed, the members of the committee to be chosen from all branches of art having problems to solve and advantages to obtain from the work of the commission, also chemists and manufacturers; and the work of the commission being to investigate the inventions and processes, ancient and modern, and to indicate in special reports those which might seem preferable, and to conduct correspondence relating to the objects of the commission, also to establish a laboratory where analyses could be carried on on behalf of the artists, dealers or manufacturers. No commercial considerations were to be entertained, and the mark of the society was to be placed on all products recognized as good, the dealer or manufacturer depositing a sample of the product and binding himself to produce a product identical with the sample. All artists would thus be assured of a pure material in no way injurious to the preservation of their works. It would be very gratifying if a scheme of this nature could be adopted, and in the end it would add to the business of the manufacturers.

Mr. Leicester then describes the various media used during the Middle Ages and in the Renaissance, and gives some of the ancient directions for preparing colors. He recommends that as far as possible, pictures should be painted on panels in preference to canvas and carefully protected on the back to guard the painting from the action of the damp. Many scientists and artists are of the opinion that pigments should be tested by exposure to diffused daylight alone, for sunshine exposures are hardly the condition under which to test the durability of a pigment from an artist's point of view. Pigments are influenced according to the pureness of the atmosphere and the dryness of the climate. It is possible to use pigments in the pure air of the country which would be greatly destroyed by the impure air of cities. In a fine, dry climate like Egypt a picture could be produced which it would be difficult to paint in England, and still remain as permanent. The artist, now as of old, is safest when he considers what pigments he should exclude rather than what new colors he can add to the palette, and the durability of the pigments should not be considered apart from the question of the medium, as many of the most fugitive of pigments having, owing to the medium they were used with, preserved their freshness for hundreds of years, and the use of copal and amber varnish with linseed oil for oil pictures is most advisable for the production of lasting work. At the present time it would be well if the scientist and the artist drew more together, in order that the emotions which the pictures are capable of conveying to the spirit which has been given to the painter shall not either be left unrecorded or allowed to fade from the book of record.

BELGIAN HARE RAISING IN SOUTHERN CALIFORNIA.

The growing of Belgian hares has recently become an extensive industry in Southern California, having its center in Los Angeles. Here, within the past two years, hundreds of firms have turned their attention to the timid little red brown hare, and thousands of hutches, or rabbit warrens, are housing the breeding or growing animals. Many of the concerns have extensive equipments costing as much as thirty and forty thousand dollars, while hundreds of others are mere boxes in back yards screened with wire netting, the proprietor of the place being some boy or woman of the establishment.

The economic value of the Belgian abides in its flesh for food purposes. This has no relation to the ordinary hare or rabbit. It is white, close-grained and tender, resembling very much the legs of frogs, being



A HIGH-BRED BELGIAN HARE

withal of delicate and most savory flavor. It is decidedly an epicurean dish, being superior to fowl of any kind; no roast could be more palatable than a good fat hare stuffed with oysters.

The animal commends itself to raising in small ways from the fact that it is very clean and will be healthy in the most limited and confined spaces. In this respect it is greatly superior to poultry; requiring neither the care nor the space of chickens. These considerations have made it distinctly the back yard pet of Los Angeles in which enclosures many thousands are now being raised. The prices of hares of good breeding points are now high notwithstanding the number in existence. A good buck or doe will bring from $50 to $250, sales at the latter price being very common. The ordinary does and bucks of the age of three months, not bred from parents of prize records, bring from $20 to $25. The sex most commonly sold is the females; a few unsalable does get upon the meat market where they are readily gobbled up at twenty-five cents per pound live weight, a price which makes the animal worth from $2 to $2.50. They are killed and dressed at the stalls while the purchaser waits. The animals can be grown to maturity for from thirty-five to forty cents, and they could be sold at seventy-five cents and great profit realized; the present prices, therefore, are very remarkable, yet they have kept steadily up since the inception of the industry and give no indication of waning.

The hares of Los Angeles come directly from England and Belgium; several of the firms make a speciality of importing. It is said that a hare having the points of the Belgian, but of smaller size, runs wild in the country to the west of Antwerp; and by the importers it is said that it was from this hare crossed with English breeds, the crossing being with regard to a table animal, that the now popular Belgian was procured. Los Angeles appears to have gotten the start upon the rest of the country as shipments are being made daily from this place to all parts of the United States, Florida being one of the largest takers. A southern climate, however, is not necessary for successful culture of the animals. It will thrive equally well in Michigan or Wisconsin and would do as well in Massachusetts as in Mississippi.

The high profit in growing the hare abides in their wonderful fecundity and in their eating cheap provender. The doe brings forth every sixty days, having from six to eleven and as high as fourteen in a litter. As the doe can only suckle eight, a white rabbit, usually an Angora, is kept in breeding to serve as nurse for the surplusage. The youngsters grow fat a rate of about one pound per month for eight months when they are matured at eight pounds. They are bred at seven months. They eat about the same food as a sheep, their preference being for alfalfa or clover hay. When the doe comes to yield her litter she prepares for them a nest of hair which she pulls out of her own body. If not prevented by spreading boards or wire netting over the surface of the ground the doe will burrow and produce her young in a chamber about five feet under the ground. In this the animal follows a trait of the rabbit and not of the hare; another rabbit quality is that the young do not open their eyes until about ten days after birth, while hares are born with their eyes open. But with all these qualities of unconformitity there is no doubt that the animal is a hare. It has the small fore limbs and the large strong kangaroo-like hind legs of the hare and it moves by leaps and bounds.

In color the Belgian is a yellowish red when mature with white upon the belly, and with long erect ears.

They are nearly black when born, turn almost gray when a week old, but darken and redden as they approach maturity.

A Belgian Hare Association has been formed in Los Angeles which has an extensive membership and all the indications are that another enduring and extensive industry has been added to the live stock interests of the country, with incident benefit to the pelt industry, for the skins make excellent furs for hatters' uses, and for the lighter winter apparel for women, while they are beginning to enter the trade as trimmings.

O. P. Walcott.

Los Angeles, Cal.

Mines of Mount Sinai.

The Egyptains had mined the rugged sides of Mount Sinai for copper and torquoises thousands of years before Moses climbed the mountain to receive the Tables of the Law, and the Egyptains waged wars for the possession of these mines. M. de Morgan with a party of French engineers recently visited these abandoned workings which is situated convenient to the Gulf of Suez, and explored two of the ancient deposits. He found the mineral deposits in the sandstone region and not in the porphyries which constitute the great mass of the mountain. These deposits consists of copper and iron-bearing minerals, especially hematite and some gypsum. Among the cupriferous minerals the most valuable were the torquoise, many valuable specimens of which which have been discovered from time to time in the tomb and treasures of the Egyptains, says The National Druggist, from which we derive our information. M. de Morgan brought back to France quite a collection of minerals most of which were turned over to M. Berthelot who made a most interesting report on the minerals, in which he stated that the copper-bearing specimens were poor in metal and not very plentiful. Mining such ores must have been tedious and severe labor. The Egyptians were still using arms of wood and chipped or ground stones and copper was a rare and precious metal, the possession of which was thought to repay the most severe labor. Later on, wood and stone implements gave place to bronze which was made possible by the importation of tin from remote regions. The extraction of the metal was effected by methods similar to those followed in the metallurgy of copper in its production of similar ores from the remotest antiquity down to recent times—the use of wood as a reducing material along with silicious, ferruginous and calcareous fluxes.

The mines have been abandoned for at least 3,000 years, probably on account of a constantly growing scarcity of the material and the poverty of the residue in metal. The mines were probably worked from 3,500 to 4,000 years. It is thought that the working of the mines began nearly 7,000 years ago.

There is a close connection and to a certain extent inter-dependence between the relations of forest fires to insect ravages, and insects to forest fires, diseases of trees to insects and insects to fungous diseases, which are not obvious at first sight. Dr. A. D. Hopkins in a report on the insects enemies of the forest in the Northwest treats quite fully of this subject. Trees dying from injury by fires or weakened in vitality offer favorable conditions for the multiplication of vast numbers of destructive insects. Moreover, the trees which have been killed by insects furnish, in their fallen branches and partially decayed trunks and dry bark, a most favorable propagating ground for the starting, spread and perpetuation of forest fires. It is, of course, well known that forest trees weakened by disease contribute to the multiplication of insect enemies to forests, therefore, the study of insects associated with unhealthy forest trees should lead to results of economic importance.

Science Notes.

The fund for the naval arch at New York city is being slowly increased. The location of the new arch has not yet been determined upon.

The Committee on Coinage, Weights and Measures of the House of Representatives is again considering the subject of the adoption of the metric system as the legal system of the United States. Now that we have acquired new territory the value of the metric system should be brought home to all.

The Russians are preparing a map of France for the Paris Exposition. Each "Department" is shown in colored jasper, while the sea is represented by lapis lazuli, the rivers by platinum and the towns, to the number of 106, are marked by precious stones. The map rests on a marble slab about three feet square.

A liquid air plant has been given to the University of Michigan by Charles F. Brush, of Cleveland, Ohio. It is actuated by a 5-horse power electric motor and its capacity is about a quart of liquid air an hour. It is to be used in the laboratory for cooling purposes for certain reactions. It will also be used to furnish liquid air for experimental purposes.

The ugly church of St. Maria Liberatrice on the edge of the Roman Forum is to be demolished and excavations have been made on its site. The church was bought for 375,000 lire, although a million lire was at first asked. It was a prominent object in all views of the Forum, but the results of the explorations on it will be of the most value. This will be the first step toward the noble scheme of reuniting the Forum and the Palentine.

The Municipal Council of Venice has voted a message of condolence to the family of the late John Ruskin. They have also decided to place a memorial tablet upon the house where he lived while he was gathering his materials for the "Stones of Venice." This is certainly mere justice, for Ruskin really discovered Venice and made it famous. A considerable amount of the annual income of this most curious of cities may be directly traced to his influence.

The Prussian Meteorological Institute is about to arrange for the systematic examination of the Aëronautical Observatory at Tegel, near Berlin, says The Engineer. Kites and balloons will be employed at heights from 3,000 to 5,000 meters to ascertain the atmospheric conditions. The registering apparatus is taken up by a kite-balloon inflated with hydrogen, and can lift 500 meters of wire. To it a second kite is attached and to this latter a third, and so on until the balloon reaches a height of 4,000 or more meters.

Plans for the Passion Play have now been definitely announced. The prices for seats will vary from 50 cents to $2.50, and excellent accommodations can now be obtained in the town which can be reached by railroad. The part of Christ will be played by Anton Lang, a young man who has not before had any important part. Joseph Mayr, who played the part in 1870–71, and 1880 and 1890, is now too old for it. It is a mistake to suppose that the scenery is crude and that the acting is bad. The scenery is painted by some of the best scenic artists in Germany. The costumes are elaborate and the acting is excellent. The little Bavarian town will certainly be visited by thousands this year.

There is now on exhibition in London an employes' checking clock which, in addition, takes a picture of the employes, says The Railway and Engineering Review. The apparatus resembles a somewhat bulky camera with a large lens aperture in front and a button to be pressed just below the opening. Inside the box is a clock and a sensitized ribbon. The idea is that the instrument should be placed in a suitable position near the employes' entrance and that on his arrival and departure each man should stand in front of it and press the button. The result is that a tiny photograph of the clock is taken on the ribbon of celluloid of the employe who is registered. It is claimed that forty attendances per minute are easily recorded. The records can be taken out once a week and can be made ready for checking attendances by an office boy in a short time. This seems however, a very clumsy method of keeping time.

A recent number of The Philosophical Magazine contains a paper on earthquake sounds, by Dr. C. Davison, a somewhat neglected branch of seismology. The sound is described, says Nature, as generally deep and rumbling, like that of a heavy wagon passing. It sometimes resembles thunder or wind more closely, the fall of heavy stones, or the fire of distant cannon. Near the epicenter of the earthquake loud crashes are heard by some, but not all, observers at the time when the shock is the strangest; further away it becomes rougher and more grinding at this moment, while at a greater distance the sound is throughout smooth and almost monotonous like the low roll of distant thunder. The neighborhood of the sound at the lower limit of audibility is shown by the fact that it is heard by some observers like the rumbling of a heavy traction engine passing, while others equally alert hear no sound at all.

Engineering Notes.

According to The Engineer fifty thousand tons of bituminous coal are being shipped from Philadelphia by contract to Italy. It is for use on the railways and the price is estimated at $1.50 per ton.

According to The Engineer, grindstones should not be run by gas engines if they run other tools, as the putting on and throwing off of the power affects appreciably their speed, and thus causes the stones to burst.

The Exposition authorities are anxious on account of the condition of the Seine, which in rising has done considerable damage to the buildings along the river bank. The infiltration of water has sunk one of the wings of the Palace of Electricity ten feet.

It is said that up to November 20, over 1,300 projectiles were thrown into the besieged town of Mafeking by the Boer guns with the extremely feeble results of six persons killed. This, says The Engineer, probably forms a record of ineffectiveness in the annals of military warfare.

Excellent results have been obtained with the use of oil in blast furnaces. It is interposed between the hot-air stoves and the tuyeres of the blast furnace. The oil is drawn by the blast into the furnace where it increases the temperature and also facilitates the reduction of the ore.

The following from an Indian contemporary is interesting:

The running of night trains on the Howrah-Amta Light Railway has been permitted at a speed not exceeding ten miles an hour, on the condition that the locomotive carries a 1,500-candle power Wells' light. The line is ballasted, but, we believe, is unfenced, and the precaution of a powerful Wells' light on the engine is a wise one.

The clinker from the refuse destructors at Bradford, England, which in 1894 cost nearly $5,000 for carting and dumping, is now turned to profitable purpose in mortar and concrete making, says The Practical Engineer. Ground and mixed with cement, it has been found to give excellent results for the formation of reservoirs and inverts. During the winter months screened clinker has found favor for sprinkling on roads made slippery by the frost.

There are several places in New York where the crossings are extremely dangerous even for an agile man, and something should be done to ameliorate the condition. Thirty-fourth Street and Broadway is possibly the worst crossing, and Twenty-third Street and Broadway is about as bad, although the angles at which the lines cross are better. It has been suggested that "islands of safety" or "refuges" be built at points between the pairs of tracks, in order that the pedestrian may have a moment's rest before crossing and where they can remain in safety until the policeman is able to conduct them across. The preferable form of such shelters would be circular and the platforms should be high enough to stay the progress of even a runaway carriage. Such shelters would greatly simplify the work of the police.

The number of manufacturers of acetylene generators is quite large in France and in other countries, says Le Monde Moderne, while the number of consumers is constantly increasing. In Germany, in 1898, according to published statistics, the manufacturers sold 35,000 generators capable of supplying altogether 113,000 burners. In other countries, the proportion is almost the same. This indeed shows progress, but the fact remains, nevertheless, that acetylene has not yet shown that development which was expected of it, and this is due to the fact that no really practical generator has yet been devised for use by the small householder who wishes to have his own plant. On the other hand, if the gas is delivered highly compressed, in cylinders, the user is exposed to dangers, the reality of which has been confirmed by sad experience. There yet appears to be a solution of the problem which furnishes some interesting results; it is what is known as dissolved acetylene. MM. Claude & Hesse discovered that this gas can be dissolved in acetone which, at ordinary temperature, absorbs twenty-four times its volume at atmospheric pressure. This proportion can be considerably increased by lowering the temperature, and, at 80° C. below zero the acetone absorbs more than two thousand times its volume of gas. Unfortunately under these conditions, it could not be practically made use of. Returning then, to ordinary temperatures of from 15° to 20° C., if a pressure of 10 atmospheres is used, which is not a dangerous one, there may be stored in a liter of acetone 240 liters of gas. In order to make it still safer, the company has recently perfected this process by adding a species of filter, formed of a porous ceramic, which is so placed in the reservoir as to effectually check the gas in it from being ignited from the burners. It has been demonstrated by experiment that in tubes of small diameter the flame of this gas does not spread, and the porous material constitutes in reality a series of small tubes. The P.-L-M. railway company is about to try this system on its cars.

Automobile News.

Automobiles are not allowed in the Forest Hills Cemetery, Boston. This rule was made to obviate the danger of accidents.

Special bells are now being made for automobiles. They can be attached to the footboard and can be reached by the foot of the operator.

Steam carriages cannot as yet be run freely in Paris. An application has been made to the Minister of Public Works for permission to run such carriages.

The British Government is endeavoring to purchase five automobiles of the "tracteur" class, each capable of drawing two tons. They are for use in the Transvaal.

The motor vehicle is likely to prove valuable for piano moving. A Cleveland firm is now using one made by the Woods Motor Vehicle Company, of Chicago, Ill,

At last the automobile has reached the department-stores. One prominent New York firm is offering automobiles for $1,200. The advertisement announces that one is ready for delivery and that others can be furnished in a short time.

At the electric cab station in Boston where there are over 100 automobiles, arrangements are provided for working the carriages after the batteries have been removed. An electric cable is suspended from the roof and this transmits the power to the carriages by the aid of a plug so that the carriages can be run around the floor with its aid.

The tour of England which is now being arranged for by the Automobile Club of Great Britain and Ireland will be one of the interesting events of the year. The automobiles entering the competition are to cover a route of 1,000 miles, laid out from London to Edinburgh and back, passing through a number of the larger cities, in each of which the vehicles will be put on exhibition for one day. This event will be preceded by the Automobile Exposition, which is to be held under the patronage of the club in Agricultural Hall, London, April 14–21. It will be probably be followed by an exhibition of the vehicles which have taken part in the 1,000-miles' tour, from May 12–19. Among the cities to be passed through on this tour are Bristol, Birmingham, Manchester, Edinburgh, Newcastle-on-Tyne, Leeds and Sheffield, these being separated by distances varying from 65 to 135 miles. Prizes are to be awarded by the club to the amount of $5,000.

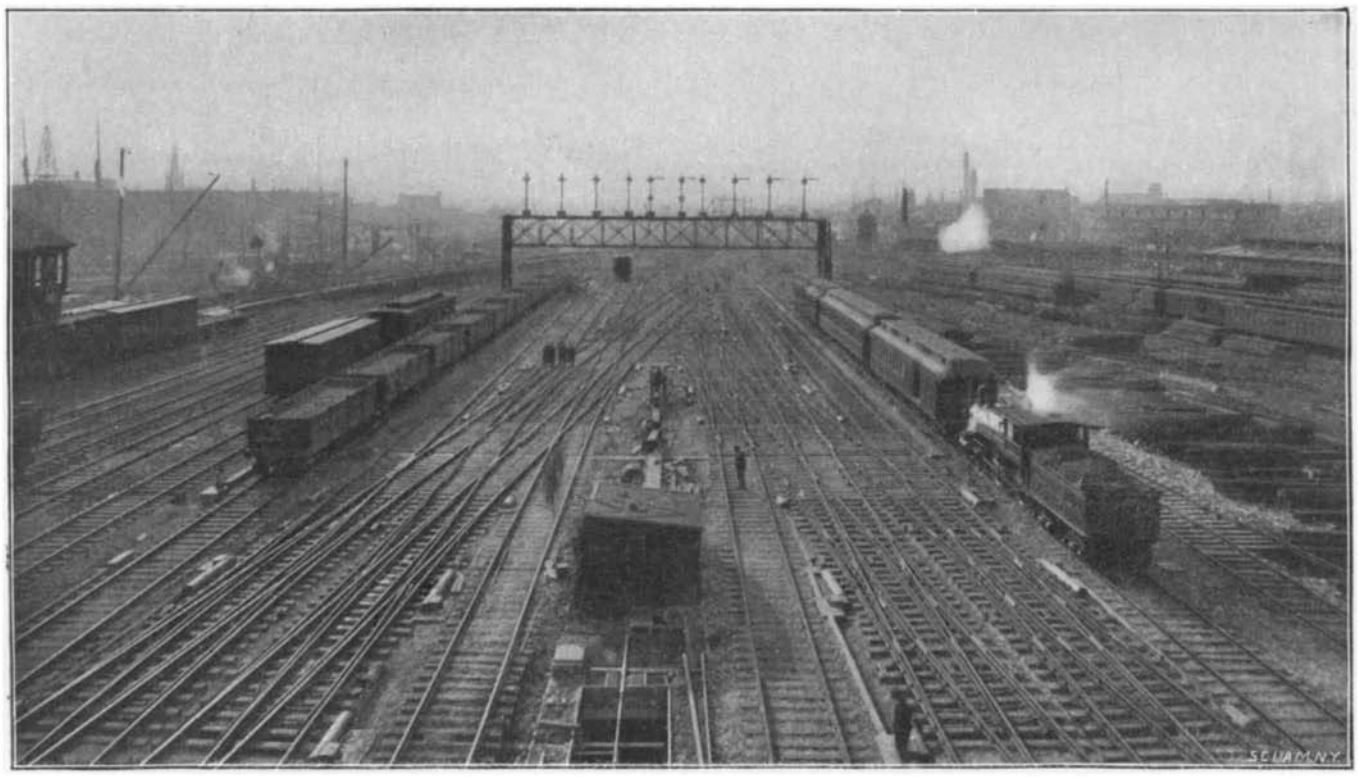
The Automobile Club of France has received the names of four clubs which intend to compete for the Gordon Bennett cup, these being the Automobile Clubs of America, Germany, Belgium and Italy. According to the rules previously laid down, the entries closed on December 31 last, and therefore, the cup will be contested for by the five clubs above named. The Belgian Club takes a wise precaution in having its representatives compete first in the Paris-Bordeaux races, which will take place on June 14 over a route of 568 kilometers to be decided upon later. The three conductors who make the best record will be chosen to represent their club, on condition that an average speed of 40 kilometers per hour be attained; this matter will be looked after by a committee of experts appointed for the purpose. The same club has signified its intention to require the makers of the vehicles used in the contest to furnish a certificate stating that they are entirely of home manufacture, as the rules require. It is expected that the other competing clubs will adopt similar measures. To distinguish the vehicles of each country, it is probable that they will be painted a different color; thus the French automobiles will be painted blue, the German red, etc.

The programme for the international competitive tests and races to be held in connection with the Paris Exposition of 1900, at Vincennes Park, has recently been decided upon by the Automobile Club of France. There will be six principal events, one being held every month, lasting for five days. The first of these will be a competitive test of touring vehicles, commencing May 14, including automobiles of 2, 4, 6 or more places. This will be followed by a test of cabs for city service, on June 18. A series of races at high speed will be held, commencing July 23; this includes three classes, large and small automobiles, and motocycles. On the 13th of August the small vehicles of two places, breaks, phætons, etc., will be represented; on the 17th of September, light delivery wagons. The last of the tests will be held October 8–13, and will include heavy vehicles of all descriptions for the transportation of freight and passengers. A space has been set apart in the park for each of the two main classes, bicycles and automobiles, the latter including moto-cycles. Each of the sections will be provided with a race-track. A charging station is to be erected for the accumulators of the automobiles, besides supplies of gasoline, oils, pneumatic tires, etc. Sheds are to be provided with facilities for cleaning the vehicles when they leave the race-track before entering the exhibition hall.

ELECTRO-PNEUMATIC SWITCHING AND SIGNALING SYSTEM AT THE SOUTH BOSTON TERMINAL STATION.

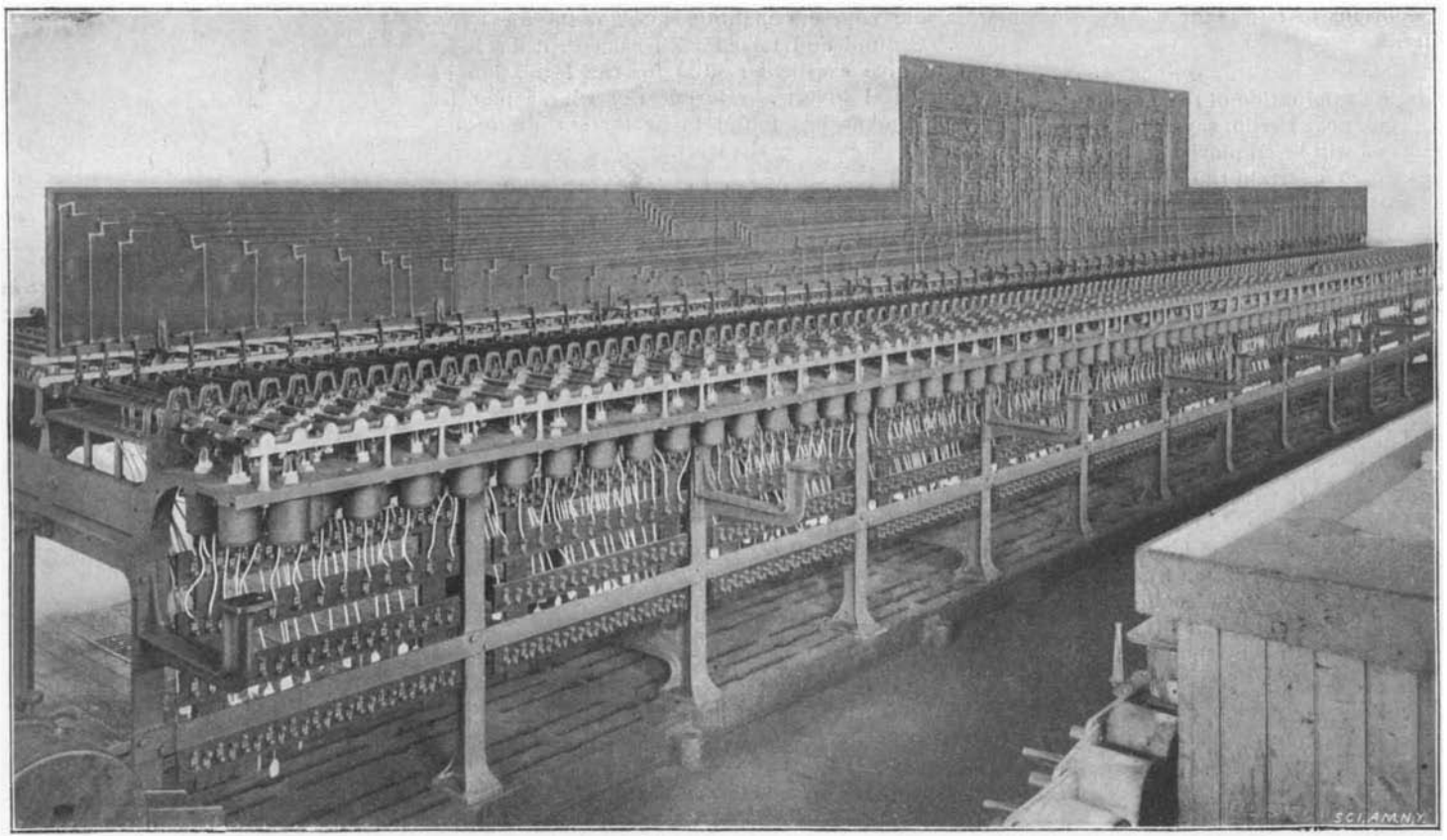
The vast size of the new South Boston Terminal Station necessitated the planning and construction of special work in more than one department of mechanical and civil engineering. Not the least complex and difficult problem was the arrangement of a satisfactory system of signals and switches, for expeditiously and safely controlling the great volume of traffic which day by day rolls into or out of the station. We have already, in our issue of January 14, 1899, given an illustrated description of this remarkable station, which was opened for traffic at the commencement of last year.

It will not be amiss in connection with the present article to recapitulate some of the leading features of this great work. The station was built to provide terminal facilities for the express and suburban traffic that enters Boston by four different railroad systems, namely, the Providence division of the New York, New Haven and Hartford Railroad, the Old Colony, the New England, and the Boston and Albany railroads. This traffic is estimated to amount annually to about 25,000,000 passengers. Whereas it was formerly handled in four separate and scattered stations it now enters and leaves from one common center. The total area of the terminal site, including the great yard, of which we present an illustration, is thirty-five acres, and thirteen acres of this is covered by the building itself. The maximum length of the main station is 850 feet, its maximum width 725 feet. The trainshed itself, which is 602 feet long by 570 feet wide, is covered by one vast curved roof, which is supported on a series of huge cantilever trusses, the middle span of which is 228 feet, and the two side spans 171 feet in width. The mere statement of the area of the trainshed does not represent the extent of the accommodations for tracks, as the station is of the double-deck type, the long distance express traffic being handled upon twenty-eight parallel "stub" tracks on the main floor of the building, and the suburban traffic being accommodated on a two-track loop, located on the lower level below the main floor, an arrangement which enables the suburban trains to unload their passengers, load up, and depart, without any of the delay due to making up trains.

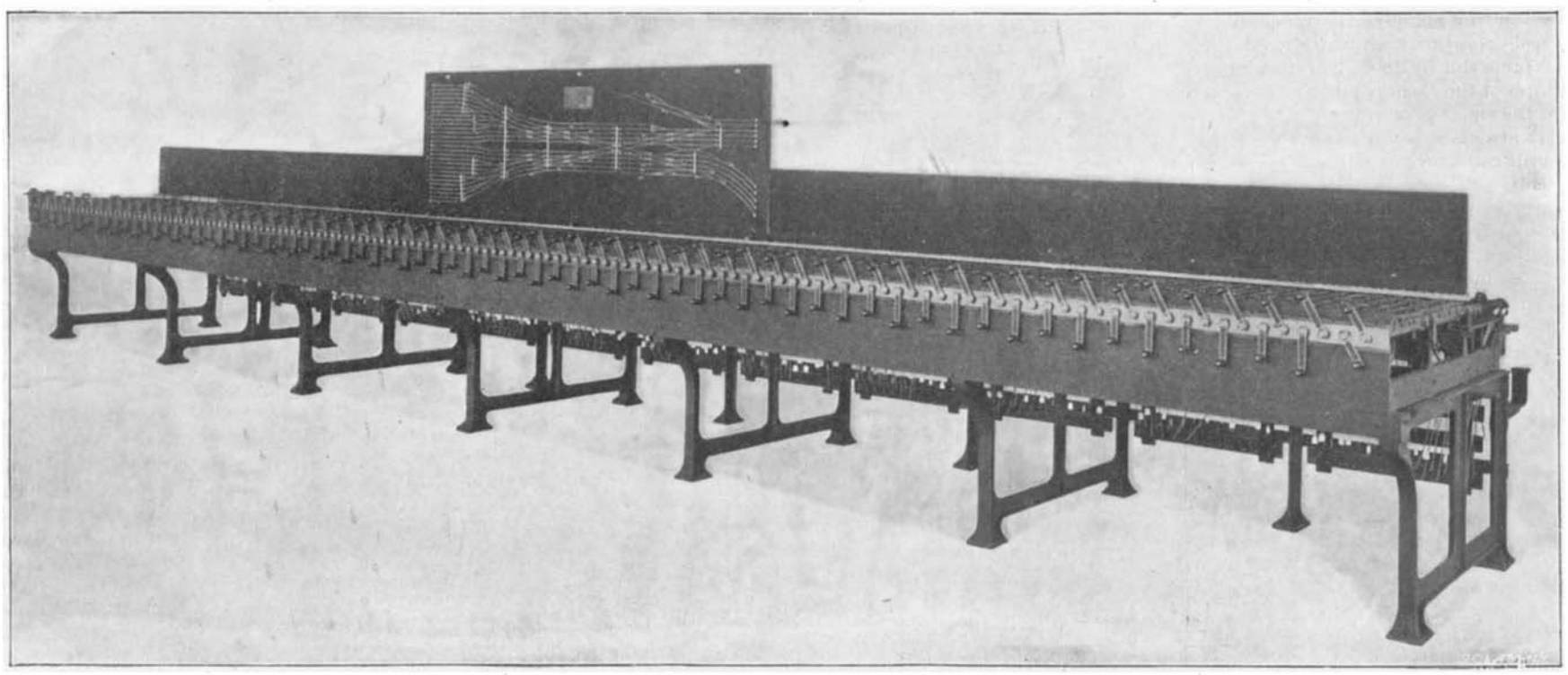


1.—SOUTH BOSTON TERMINAL YARD, SHOWING DIAMOND CROSSINGS AND SWITCHES, AND ONE OF THE SIGNAL BRIDGES.

The present schedule calls for a daily service of 737 trains. When we remember that the making up of these trains will involve an even larger number of train movements, it can be seen that the track layout must necessarily be very extensive and elaborate. In determining what system of switching and signaling to adopt, it became a question of choice between a mechanical plant, in which the connections from the signalmen at the tower to the signals and switches are made by means of an elaborate system of bell-crank levers and pipe connections, and an electro-pneumatic system, in which the pipe connections are displaced by electric wiring and hand power by pneumatic power. A mechanical plant was out of the question because of the large tower



2.—REAR VIEW, SHOWING ROTATING SHAFTS, ELECTRO-MAGNETS AND INTERLOCKING BARS.



3.—FRONT VIEW OF ELECTRIC INTERLOCKING MACHINE, SHOWING OPERATING LEVERS AND WORKING MODEL OF YARD.

building which would be required, and the large amount of valuable land that would be occupied by the lead-out piping, the width required near the tower in each direction being about 45 feet. Moreover, the electro-pneumatic system is more economical in labor, and it is estimated that on account of the magnitude of the plant, the cost would be as great, or even greater, for a mechanical than for a pneumatic installation.

The yard is controlled from three towers. Tower number 1, which is the nearest of the three to the station, controls an area of tracks in which there are switch and frog points equivalent to 238 ordinary switches. It is possible for eleven trains to move to or from the trainshed at any one time; and for the control of these there are 148 semaphore signals. Tower number 2 controls the switches and signals of the suburban tracks; and tower number 3 has charge of the train movements at the yard limits, which are too remote to be controlled by tower number 1. There are nine steel-truss signaling bridges in the yard, which serve to carry the greater part of the signals. One of these bridges, carrying ten semaphore posts, is shown in our engraving of the yard. The posts are hollow iron columns with the operating connections inside, and as far as possible they are placed vertically over the center of the track which they control. Forked blades are used to indicate that a route clear through the system has been arranged, and they are also used at the last signal before entering the trainshed, to indicate that cars are standing on the track in question, within the shed. Red indicates "stop;" green "all right" and yellow "caution."

The switches and signals are operated by compressed air, which is piped to the desired points throughout the yard. Single-acting air-cylinders controlled by magnets are used to raise the signal arms, which are brought back to a stop position and held there by counter-weights. The switches are moved by double-acting air-cylinders, which are provided with two pin valves, magnetically controlled, one for each end of the cylinder, which serve to control the auxiliary cylinders that shift the D-valve. The D-valve cannot act until a plunger which prevents its movement is withdrawn, the withdrawal is effected by a third magnetic valve and auxiliary cylinder. The three magnetic valves are controlled by three separate wires, which lead from them to the contacts of the interlocking machine at the signal tower. The first part of the stroke of the main piston moves the detector bar, the middle part moves the switch, and the latter part locks it in position. Hence, if the detector cannot rise, being held down by the wheels of a passing train, the switch cannot be thrown. The pneumatic cylinders which operate the semaphores are controlled by similar magnetic devices.

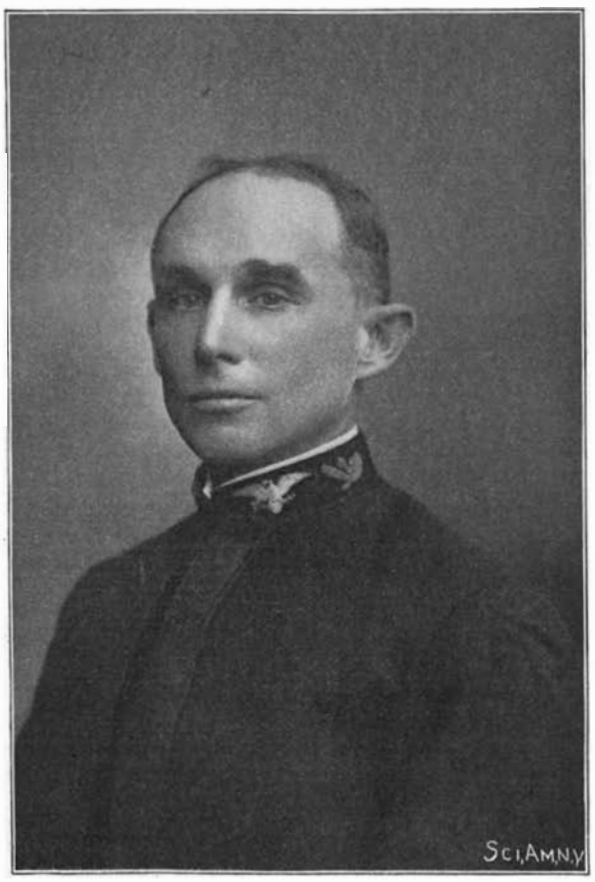
We present two illustrations of the interlocking machine as installed at the principal signal tower, No. 1. Each pair of switch points and each semaphore, in that portion of the yard controlled by this tower, is connected by wiring to this inter-locking machine, which has complete control of the action of the electro-magnets throughout the yard. Running transversely across the interlocking table, and operated by the small hand-cranks shown in the front view of the same, are a series of horizontal rotating shafts which are capable of being moved through an arc of sixty degrees. At their rear end the horizontal shafts are provided with electric contacts, and below them are arranged the armatures of the series of magnets which will be seen in Fig. 2, supported below the rear edge of the table. The manipulation of the horizontal shaft by the signalman serves to give the required condition to the magnets at the switches and signals throughout the yard for their operation.

Arranged above the interlocking table at right angles to the rotating shafts, and extending its full length, is a vertical board, upon the back of which are carried a series of transverse and vertical bars, to which horrizontal and vertical movements are given by means of bell-crank levers. Each horizontal rotating shaft is connected to its own system of transverse horizontal bars. The bars are arranged to interlock with one another by a system of cross-locks. The ends of the rotating shafts are engaged by the armatures of electro-magnets, which are so governed, by the switches and signals operated, that the levers and apparatus operated by them must agree in position before a prescribed route through the yard may be given.

A working model of the yard is attached to the interlocking machine and faces the signalman as he stands at the front of the table, see Fig. 3. The working model shows all of the switches moved by the interlocking machine, and every movement of the switches or signals throughout the yard is faithfully represented on the model as it takes place. We are indebted for our description to the courtesy of George B. Francis, M.Am. Soc. C. E., resident engineer of the Boston Terminal Company.

NAVAL CONSTRUCTOR FRANCIS T. BOWLES.

Francis Tiffany Bowles, son of Benjamin F. Bowles and Mary Elizabeth Bailey, was born in Springfield, Mass., October 7, 1858. His grandfather, Samuel Bowles, was the founder, and his uncle the great editor, Samuel Bowles, of the Springfield Republican. The family is



FRANCIS T. BOWLES, U. S. N., CHIEF NAVAL CONSTRUCTOR OF THE NEW YORK NAVY YARD.

of clear New England Puritan stock and allied on every side with well-known Puritan names.

In 1875, Mr. Bowles entered the Naval Academy as a cadet engineer. Early in the course, he determined to become an Assistant Naval Constructor. Although provided for by law, no appointments had ever been made from graduates of the Naval Academy, owing to the opposition of the old school of constructors.

In order to thoroughly equip himself as a naval architect, Mr. Bowles applied, during his last year at Annapolis, for permission to attend the School of Naval Architecture at the Royal Naval College, Greenwich, England. His request being seconded by Senators Edmunds and Dawes, the Secretary of the Navy made application to the English Government for Mr. Bowles and his classmate, Richard Gatewood, to take the three years' course. These young men began in 1879 a course of study which has since been the highest prize attainable by distinguished graduates of the Naval Academy, and has proved a most efficient method of recruiting an efficient corps of Naval Constructors. Mr. Bowles' instructor in naval architecture was Sir William White, now Director of Naval Construction of the British Admiralty.

Mr. Bowles, coming fresh from the English and Scotch shipyards in October, 1882, and charged with the latest information as to design and construction, was soon detailed as Secretary of the Naval Advisory Board, then charged with the control of the design and construction of the first ships of the new navy. It is difficult to realize now the then existing conditions of dense ignorance as to the real state of the art of ship and engine building, and Mr. Bowles was met with the most absolute incredulity as to the results obtained abroad. It is interesting to recall that the ships recommended for the navy by the first advisory board were all single-screw vessels, even up to a first-class cruiser of 6,000 tons. They were all unprotected, sheathed with wood, of full sail power, with gun deck batteries, and a speed of 10 to 15 knots for the various classes. Twenty of the small vessels were to be built of wood, and on the material for constructing the others the board divided, part advocating steel and part iron.

Mr. Bowles struggled to infuse the new ideas and succeeded in many important features of the designs. He advocated twin-screws for all the ships, a system which was adopted for the "Chicago." He made and secured the adoption of the battery plans of the "Boston" and "Atlanta." He fought against sheathing with wood and won his case so thoroughly that the question has laid at rest until recently. His services on this board, which extended over its active service of four years, are described in a letter of the late Rear Admiral Simpson, at one time president of the board:

"Mr. Bowles has been attached to the board since its inception, and as the center figure about which the business of the board has circulated, he has shown an amount of method and system, which combined with a very retentive memory, has made him a valuable, and, I may say, an unfailing reference at all times. This, however, would indicate but faintly the value of his services, which could not have redounded to the credit of the service and his own reputation without the knowledge he possesses of marine architecture and engineering, both of which have been frequently utilized by the board."

Secretary Whitney made Mr. Bowles a member of the Walker Board, which prepared the designs of the "Newark," "Charleston," "Yorktown," etc.

In 1886, Mr. Bowles was detailed to the Norfolk Navy Yard, and was soon placed in charge. He there organized a modern shipbuilding plant, producing with the very small means available the Navy's most efficient yard. He built the battleship "Texas," the cruiser "Raleigh," and completed the monitor "Amphitrite." During this tour of duty, extending over nine years, he served as a member of all important boards at Washington having to deal with matters of ship design.

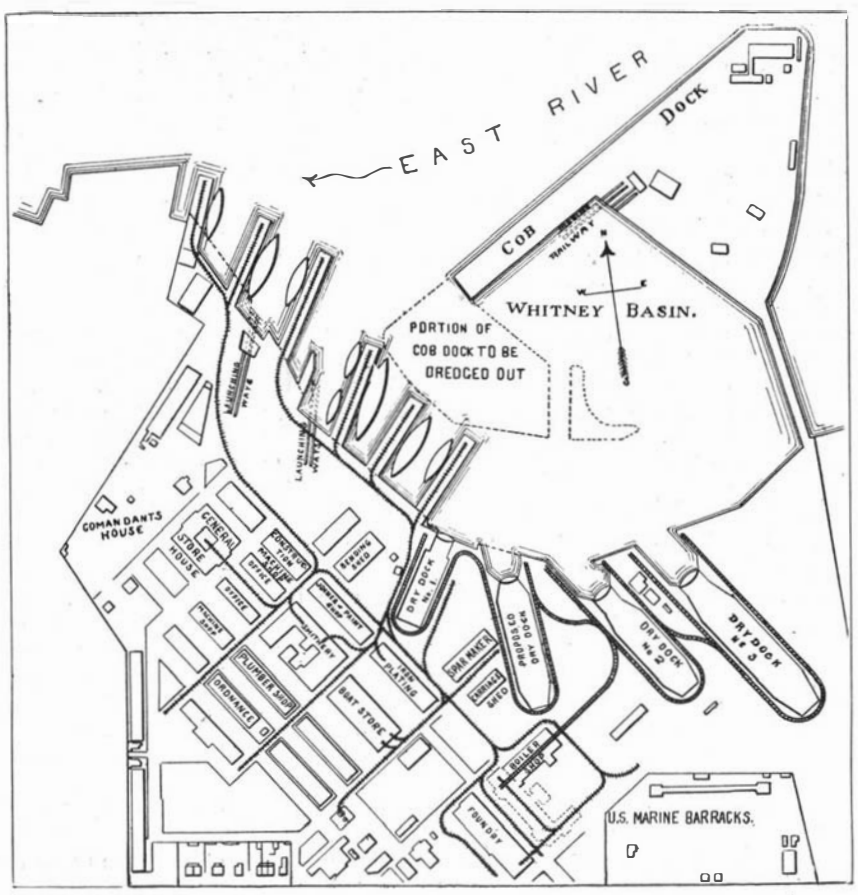
On his departure from Norfolk the employes adopted resolutions, testifying to his "executive ability and skill," thanking him for "his untiring energy as manifested for the advancement of this yard, in securing the necessary tools and appliances for the construction of vessels," and congratulating him on his promotion to the New York yard, "the best appointment in the gift of the department."

Mr. Bowles' administrative and business capacity has always been recognized in the navy, as well as his unflinching demand for efficient personnel in the navy yards. This has frequently brought him into conflict with politicians, and led to investigations of his conduct of affairs, which have always resulted in credit to himself and confusion to his enemies.

Secretary Tracy consulted him in regard to the introduction of Civil Service into the navy yards and made large use of his knowledge and experience in framing the first rules put in force.

Mr. Bowles came to the New York Navy Yard in 1895, being detailed by Secretary Herbert at a time when certain irregularities were found in the employment of men in violation of the rules. He proceeded quietly and effectively to rid the place of incapable, idle and worthless employes who had infested it for years, and has produced an organization whose efficiency was demonstrated clearly in the Spanish war, when the work turned out at the yard won the admiration both of the navy and the business community.

In September, 1897, desiring the earliest possible completion of the repairs to the large dry dock at the New York Navy Yard, the Secretary of the Navy placed the work under the immediate charge of Mr. Bowles, by whom it was brought to a successful conclusion and the dock put in excellent condition. Since its completion,



PLAN OF THE NEW YORK NAVY YARD, BROOKLYN, SHOWING PROPOSED IMPROVEMENTS.

all of the largest and heaviest ships in the navy have been successfully docked therein.

During the Spanish-American war there were 2,200 construction employes, averaging 14 hours per day, under Mr. Bowles' orders. Due largely to his remarkable executive ability and quick and correct decision, there were fitted out at the New York Navy Yard, for auxiliary service, forty-seven vessels—as many as were turned out in all other yards together. Mr. Bowles was further in complete charge of fitting out the army hospital ship "Relief," which for completeness of hospital arrangements is to-day unsurpassed. Secondary batteries were fitted on the "St. Louis," the "Harvard" and "Yale," without interfering with their movements. In many instances, the alterations were outlined, plans made and issued, and work begun within twenty-four hours after a vessel's delivery at the yard.

Mr. Bowles was the prime mover in the organization of the Society of Naval Architects and Marine Engineers. From its incorporation he has been Chairman of the Executive Committee of the Council, and since 1895 has also served as Secretary-Treasurer of the society. In moving him a vote of thanks, Vice-President Loring, of the society, stated "In the work of inception and execution, the master mind and guiding hand have been those of Naval Constructor Francis T. Bowles." Col. Edwin A. Stevens, member of the Council, said: "I take it that we can regard Mr. Bowles' work in fostering this society. . . . as an example of the spirit of the service, taking Mr. Bowles as the type of the re-constructed navy of the United States, of the men that have made that re construction possible." Sir Nathaniel Barnaby calls the corresponding English organization "The home for research in naval construction;" and due to the efforts of Mr. Bowles, the American society has come to occupy a similar place and is meeting with great success in its object, "the promotion of practical and scientific knowledge in the arts of shipbuilding and marine engineering and the allied professions."

NEW YORK NAVY YARD, BROOKLYN.

One of the most evident facts demonstrated by our late conflict with Spain was the important part which must always be played by the navy yards of the country in the successful prosecution of a war—a fact too little understood or too long overlooked by Congress. Only those who were *au courant* with our deficiency in dry docks and other essential facilities knew to what straits we might have been brought by the sudden crippling of half a dozen of our deep-draught ships, and the consequent demand for instant docking. Happily, however, Congress seems now to have awakened to the importance of this question, and our various yards will soon be suitably equipped to meet the needs of an ever-growing navy.

By far the most important of the navy yards of the United States is that known officially as the Navy Yard, New York, and popularly as the Brooklyn Navy Yard. It bears the same relation to our navy as Portsmouth and Chatham to the British navy, and Brest and Toulon to the navy of France, and some idea of its capacity may be gathered from the fact that in the course of a single year as many as 120 vessels have visited the yard for repairs or alterations, 50 of these being vessels of the regular service and 70 of them being vessels on which considerable structural changes were necessary in transforming them to suit the needs of naval service. In the same period 66 vessels were docked and painted.

Location and History of the Yard.—If the reader will take up a map of New York he will notice that the East River for the first mile and a half of its course from the southern end of Manhattan Island, runs in an easterly direction and then turns sharply to the north, making a bend of about 90 degrees. The outer angle of the bend forms what is known as Wallabout Bay in which is situated an island, separated (save for a narrow causeway) from the main land by the Wallabout Channel. The island, the channel and most of the adjoining land encompassing the channel, go to form the 213 acres inclosed within the boundaries of the New York Navy Yard. Historically the site will always possess a mournful interest owing to the fact that during the Revolutionary War the British prison ships were moored in the Wallabout Channel, and that on board of these vessels thousands of American patriots perished. They were buried right in the mud flats of the bay upon which stands the present dry docks and buildings of the Navy Yard, and during the excavations for various new structures, portions of skeletons have frequently been exhumed. This has occurred as recently as February of this year, when in excavating near the clothing factory, fragments of several skeletons were brought to light.

For the origin of the New York Navy Yard we must go back to the year 1801, when the Chief Executive of the United States, John Adams, having exhausted every argument to induce Congress to appropriate the necessary money, purchased on his own responsibility the sites for six navy yards. Among the yards thus secured was the "Waallbought," Brooklyn, now corrupted into "Wallabout." Subsequent additions were made in 1824, 1848, and 1867, and at a later date two sections were sold to city of Brooklyn, one of which is occupied by the well-known Wallabout Market. The present value of the yard, with its docks, buildings and plant, is estimated at about $19,000,000.

The extent of quay wall available for the berthing of vessels is approximately one and a quarter miles. The boundary limits are on an average about one-quarter of a mile from the water front and the yard including the island known as Cob Dock, contains as we have said, some 213 acres. The greater part of the buildings were erected prior to the reconstruction period of the navy, which dates from about the year 1883, at which time the buildings and machinery were entirely inadequate to the requirements of a modern navy yard. Subsequently to the date mentioned, and particularly during the last decade, the more generous appropriations and the advent of vigorous and competent officials to the yard, have resulted in a great improvement of its capacity for every kind of naval work. Many old and unsuitable buildings have been torn down, and replaced by modern structures, fully equipped for the necessities of the new navy. Complete arrangements have been made for receiving and disposing the vast quantities of naval stores of all descriptions which pass through this principal supply depot of the navy. Complete electrical plants, both for lighting and power, have been installed, and elaborate hydraulic and pneumatic plants have been laid down. The quay walls have been extended, and, by dredging, have been made available for vessels of great draught of water. At the commencement of the era referred to the yard possessed but one dry dock, the old stone dock, with a length of only 370 feet. Since this two large docks, one 500 feet in length, and the other 670 feet have been constructed, and the 500-foot dock is now being largely rebuilt in concrete.

An important feature in connection with the arrangement of the docks is the system of double-track railways which encircles each dry dock and by means of connecting branches unites them with the boiler shop. On this system there are two large 40-ton locomotive cranes which have a reach of about 60 feet. The arrangement of the tracks is such that it is possible for the crane to pick up a boiler in the boiler shop, carry it to any one of the dry docks, and lower it directly into the hold of the vessel. These cranes are also of the greatest service in handling guns, gun carriages, and the heavier pieces of machinery and ship's framing and fittings. One of our illustrations on the front pages shows the yard floating derrick which has a capacity of 75 tons at the end of a 65-foot boom. One advantageous feature of this derrick is that the boom is capable of rotation about the mast. The floating derrick and the large locomotive cranes just referred to make it possible to handle the heaviest weights with ease and dispatch. There is also an elaborate system of single-track railway, as indicated by the single line on the accompanying plan of the yard. It will be seen that the tracks extend down the whole water front and through the main streets of the yard, short branches being run from the streets into the various shops.

Buildings.—The buildings of the yard are commodious and of a very substantial character. The older structures have been largely rebuilt and refitted and there are several entirely new structures that have either just been completed or are in process of erection. The largest building is the smithery, which measures 300 × 200 feet. The foundry is 350 × 110 feet, and the main machine shop of the Steam Engineering Department measures 350 × 100 feet with a wing 210 × 95 feet. The general storehouse measures 200 × 200 feet, and the joiner and paint shop is contained in a fine granite building which is over half a century old, in which is also the Construction and Repair Electrical Plant. On the summit of the hill, in the northwestern corner of the yard, is situated the commandant's house, now occupied by Rear Admiral J. W. Philip, well known as the commanding officer of the "Texas" during the Spanish-American war. It will interest our readers to know that the first commandant of the yard was Lieutenant Jonathan Thorne, the hero of Washington Irving's "Astoria."

The Department of Construction and Repair.—The work undertaken at the Government Navy Yard is so complex as to necessitate its division under various departments. The most important of these is the Department of Construction and Repair, which has charge of all work connected with the hull proper of the vessels. It has charge of the important work of docking, painting and undocking; it installs and supervises all piping in connection with the drainage, water, and ventilation systems; it looks after the necessary work in fitting up the quarters and receiving spaces of ships, and provides the necessary furniture and various details essential to life aboard ship; it has under its supervision the steering machinery and that for the hoisting of anchors and handling of the many boats with which all naval vessels are supplied. It also has charge of building the boats themselves, and in this connection it should be mentioned that a large three-story boat storehouse has been planned which will be erected on the spot indicated in the accompanying map of the yard. Electric traveling cranes, running from one end to the other on each floor, will enable the boats to be picked up and carried to a well at one end of the building, where they will be lowered on to suitable trucks on the yard railway and carried to the water.

There are thirteen buildings connected with this department, and in addition to these a large steel storehouse is in process of erection. Several of the illustrations on the first page of this issue show the interior of these buildings and the various improved tools and appliances in the shops. Limitations of space prevent any very detailed description, but we draw particular attention to the gas plant which furnishes the necessary fuel for the various forges for the plate-bending sheds and smitheries. It consists of a Root blower which delivers air at a pressure of 2 pounds to the square inch. A part of this air passes through the large tanks of gasoline shown in the illustration, and the gas thus formed is piped to the different forges and bending furnaces. The other part of the air is carried through an air main to the various shops, and by means of an air pipe and a gas pipe at each forge the mixture is regulated according to the work to be done.

A comparatively new feature of this department is the compressed air plant, whose mains are carried to the different shops and are also extended to and around each of the dry docks. The mains at the docks are located a few feet back from the curb, and are provided at intervals with connections from which the air is piped through flexible hose to the various portable machines used for drilling, chipping and caulking both on the inside and outside of the vessel. Among the uses of air in the shops is that of wood boring in the boat shop, brass polishing, hoisting in the blacksmith and machine shops, machine molding in the foundry, and for tests of all auxiliary machinery where steam may not happen to be available.

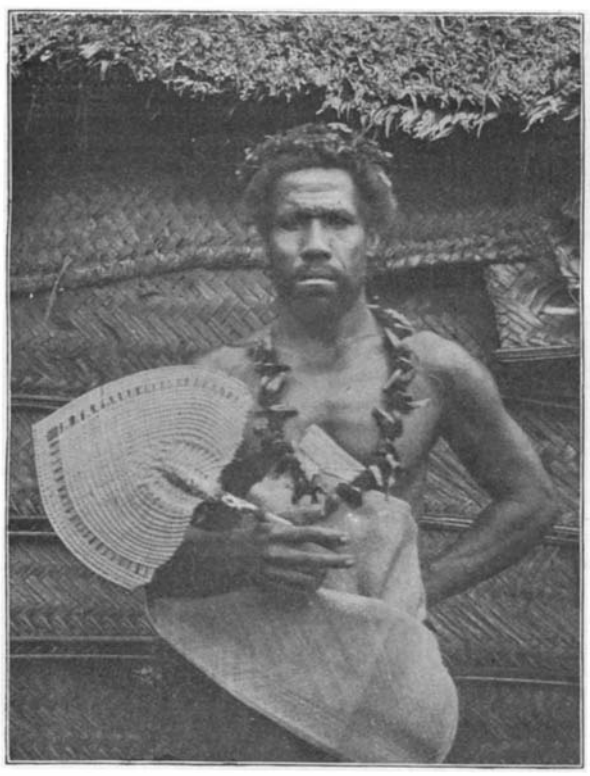
The Department of Steam Engineering, as the name indicates, has charge of all work connected with the engines and boilers of the ships, and such auxiliary machinery as is not under the direction of the Construction Department. The Department of Yards and Docks has charge of the erection and maintenance of all the yard buildings; attends to the lighting, heating, and furnishing of these buildings, and keeps in repair the dry docks, quay walls and slips, streets and tracks. The Equipment Department has charge of all matters relating to the rigging of the ships; furnishes all electrical appliances and the instruments connected with the navigation of the ships, and installs the complicated system of electric wiring which is now such an important item in the vessels of our navy. The Department of Supplies and Accounts has charge of the accounts of the officers and employes of the yard and the purchase of all material for the use of the various departments. It keeps a general storehouse supplied with naval stores for the use of all the vessels in the navy and in many cases it supplies the other navy yards as well. The Ordnance Department has charge of all matters relating to the ordnance of vessels, their guns, torpedoes, and ammunition. It has to see that the vessels are fully supplied with the ammunition and various stores connected with ordnance. The efficiency of this department was displayed conspicuously during the recent war when our vessels, not merely in Cuban waters, but in the Far East, were never in danger at any time of running short of ammunition.

Proposed Improvements.—Although the New York Navy Yard has made such a good record in respect of its ability to turn out a large amount of work, it is a fact that much of the repairs, etc., undertaken at this yard, is done at a great disadvantage, owing to the lack of proper berthing space and the impossibility of placing the ships at wharves reasonably accessible to the shops. The trouble is due to the existence of the Wallabout channel and the fact that on the navy yard side of the channel there are, at present, berths available for not more than five ships, and that of these only two are suitable for large or long vessels. This necessitates the berthing of some of the ships that come to the yard at the Cob Dock, communication with which is only possible by a slow and inadequate rope ferry, which is subject to constant interruption from passing tugs and barges. Moreover, all materials and stores for ships on the Cob Dock have to be hauled fully a mile by teams over poor roads extending around the dry docks and over the causeway.

The accompanying plan shows the scheme of alterations, drawn up by Naval Constructor Bowles, with a view to remedying this serious defect by providing ample berthing space in close proximity to the shops. The plan, which has every probability of being carried out, contemplates the removal of the southern end of the Cob Dock and the building out into the enlarged channel thus formed of six long piers and one shorter one, all projecting from the Brooklyn shore as shown. By abolishing the Cob Dock for berthing purposes, the enlarged berthing space thus afforded on the Brooklyn shore would be sufficient to accommodate at any one time eleven of the largest

and two smaller vessels, while there are the added advantages of an ample and unobstructed channel for the passage of ships from the East River to the dry docks, and that the vessels in taking up their berths at the new piers would be out of the heavy tideway which at present sets up and down the Cob Dock.

The plan of reconstruction also provides for two covered marine railways on the Cob Dock for hauling and storing torpedo boats. At present the boats are hauled out on temporary ways on the Brooklyn side,



CHIEF OF TETUILA—MOUNGA.

where the work of painting and repairs is often seriously delayed by the weather. The New York Navy Yard, as thus reconstructed, will compare favorably with the best of the European navy yards.

BUILDING WHARF AT PANGO PANGO.

Pango Pango harbor on the island of Tetuila, one of the Samoan group, is a possession of great value to a power like the United States with world-wide commerce and increasing interests and responsibilities so diversified. Though surpassed in extent by some of the harbors of Australia and China, there is not one whose advantages are greater and where the safety of a fleet from storms or attack, is so assured or so easily provided for. The island itself is volcanic and the harbor originally a crater. The dimensions of Tetuila is about thirteen miles in extreme length and is one vast range of mountains, some them 3,500 feet high.

The harbor is an ideal one with a narrow and deep entrance about one-third of a mile in width. Its dimensions are one by one-fourth miles, and throughout its entire extent a depth of forty fathoms is maintained. It is surrounded by high hills and the most violent storms of that latitude do not affect it.

The United States intrusted to a San Francisco firm the construction of a wharf 300 feet in length with a face of 400 feet, to be built of steel, which is now underway and will be completed in September. In addition coalsheds of corrugated steel capable of storing 6,000 tons are being erected and will be completed at the same time. The work is making rapid progress.

The inhabitants of Samoa are said to be delighted at the prospect of becoming attached to the United States. The more intelligent among them realizing the advantages of being protected by a powerful nation. They are all nominally Christians, though not all of one sect. Most of them follow the English missionaries, though a few are Catholics. A good many heathen superstitions and customs survive. The women are the most virtuous savages in the world, though their marriage customs seem to more civilized nations somewhat lax. The marriage relation endures only so long as mutually agreeable, when a separation is at once granted. Several of the workmen who are constructing the wharves have formed alliances with the natives who make good wives and are extremely proud of their white husbands. They are industrious and make good housekeepers. There are many chiefs among the natives and they are accorded certain privileges and great deference, but the paramount chief over all is Mounga, a magnificent specimen of physical strength, who stands 6 feet 2 inches in his bare feet. His wife is considered a fair type of an island beauty.

The island is productive and yields ample supplies of bread fruit, taro and bananas, which constitute the principal articles of food consumption. The waters also abound in fish, and the natives are very expert in catching them.

Besides the natives raise quantities of pigs and fowls, which they sell to passing vessels. The community is a happy one, and quarrels are infrequent. The climate is very warm and enervating, though the workmen employed at wharf-building enjoy excellent health.

The distance from Apia to Pango Pango is 82 miles, though the two islands are only separated by a narrow strait.

Electricity from a Snow Storm.

William A. Eddy, at Bayonne, N. J., made some interesting tests on February 17 with a kite, his object being to make an electrical test of a snow storm. A 6-foot single plane kite was used, and it was attached to a steel wire. The brush discharge could be plainly heard followed by a 1-inch spark. The electrical activity with the kite at so moderate an altitude was the greatest that had ever been experienced, the effect being about the same as if a thunderstorm had been near.

Driftwood on the Alaska Coast.

There is an extraordinary deposit of driftwood on the coast of Alaska, some 1,200 or 1,500 miles northwest of Seattle. A constant deposit of logs and driftwood has been going on for hundreds of years, and it is due to the phenomena of the tides, the Pacific Gulf Stream, the ocean currents and the peculiar formations of the shore-lines at that point. According to The Chicago Times-Herald, logs and timbers are readily identified there as having come from Japan, China, India and other localities of Asia, as well as from California, Washington and other parts of the American continent. There are fine logs of camphor-tree, the mahogany, the redwood and the pine. Some of these from the State of Washington bear the names of the men who felled the trees, and the sawmills for which they were destined. Some logs 8 feet in diameter are often seen there, and some entire trees 150 feet long, evidently uplifted by the roots during some terrible tempest. The newer logs are without bark, and they are as hard as stone, due to their long immersion in salt water.

Luncheons in Schools.

Luncheons were first introduced into the public schools of Boston five years ago, and their practicability has been established. There are now thirteen schools in all that are taken care of by the New England Kitchen managers, says The Sanitarium. The luncheons are served only in the high, Latin, and normal schools, as pupils have but one session, while in the lower grades there are two sessions and the children have about two hours at noon in which to go to their homes. At present the luncheons are served in the basements of the schools, where the light is poor and the facilities for handling the food are not of the best. In the new buildings provisions will be made for lunch rooms. The food is sold in combinations for five cents each, and ten cents supplies a fairly satisfactory meal. At the manual training-school at Cambridge, where the pupils perform considerable hard manual labor, the twenty-five-cent dinner has proved very successful. Only the very best materials are used in the cooking. The bill of fare for one day includes oyster broth, milk, cocoa, three kinds of sandwiches, graham, white, and coffee rolls, corn cake, custard, baked apples, cookies, and fruit. Everything at the schools is strictly home-made and is cooked under the supervision of those in charge of the work of the kitchen.

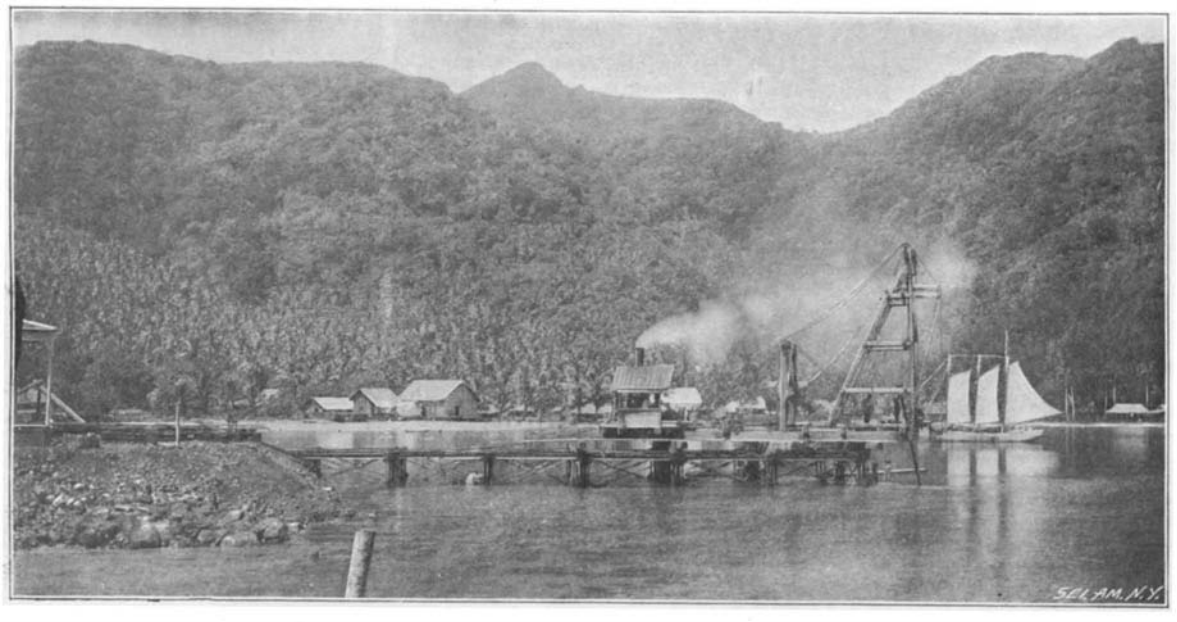
SAMOAN METHOD OF PREPARING FOOD.

The March Building Edition.

The Building Edition for March is a unique number being devoted almost entirely to beautiful houses which have been built at "Hillcrest Manor" and "Crag Terrace," in Greenwich, Conn. The houses possess many remarkable and individual features. The literary contents is of unusual importance. This is one of the handsomest numbers of this periodical which has ever been issued.

The Current Supplement.

The current SUPPLEMENT is appropriately called the "Niagara Falls Industrial Number," and forms a most valuable compendium of information relating to Niagara Falls, its history, geology, topography, railways, bridges, power plants, industrial establishments, etc. It is illustrated by thirty-five engravings. We believe that our readers will appreciate having all matters relating to the recent developments of Niagara in concise form within the limits of a single number. It will prove a valuable reference number for many years to come, illustrating as it does some of the largest hydraulic and electric machines ever constructed and some of the most interesting bridges ever built.



NEW WHARF BEING BUILT AT THE ISLAND OF TETUILA.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SUGAR-CANE CARRIER.—José Eligio Tallet, Matanzas, Cuba. This improvement in devices for handling and dumping sugar-cane comprises a series of slings or cables adapted to pass beneath the cane. One end of each sling is detachably secured to a supporting-frame, the other end permanently fastened. A tripping device is connected with the detachable connections and is operated by a member when the frame is lowered. Only one end of the slings is released; and when the frame is hoisted and removed, the slings are automatically drawn from beneath the cane. Thus the removal of the slings by hand is obviated.

PLOW-CLEVIS.—William G. Landers, Rehoboth, Ga. The clevis has its end bar provided with a vertical slot to receive a thill-iron. At one side in rear of the end bar is a vertical keeper-slot. A cross-bolt is passed through this keeper-slot, is connected with the opposite side of the clevis, and adapted to secure a link passed through the slot in the end-bar of the clevis. The improvement does away with an extra lap-ring or connecting-bolt, thus shortening the distance between the plow-beam and singletree and causing the plow to run more steadily.

HAND-PLANTER.—Charles Newman, Springfield, Mo. The hand seed-planter has a wedge-shaped point open on the rear side and normally closed by a spring jaw. The point is connected with a tube provided with a seed-hopper. An adjustable spring-foot is attached to the point and connected by rods with the spring-jaw. The operator walks in a straight line across the field, and alternately raises and lowers the planter at each step. The wedge-point thus enters the soil once at each step; and as the tube is inclined forward, the spring-foot is caused to open the point to discharge a due quantity of seed.

Electrical Apparatus.

PYROXYLIN AUTOMATIC ELECTRIC FIRE-ALARM.—Jehan de Froment, Notre Dame de Lourdes, Manitoba, Canada. Fires in buildings usually begin in woodwork in contact with defective conductors. A chimney, for example, in crumbling away, exposes the underlying woodwork to the flames. The inventor winds a pyroxylin thread around the chimney (or other inflammable part of a building) or between the floors at a few inches from the chimney. Pyroxylin (which burns several times more rapidly than gunpowder) ignites at the contact of the least spark, releases a spring, and sounds an electric-alarm. The pyroxylin, owing to its low thermostatic power, burns only at the actual fire. The inventor has publicly tested his system both in New York and Canada with very gratifying results.

Engineering Improvements.

IGNITER FOR EXPLOSIVE-ENGINES.—Fred J. Macey, Ontonagon, Mich. It often happens that the firing-pins or contact-points of vertical explosive-engines become coated either with dirt or with oxid, so that the spark is not properly produced. To overcome this objection, the inventor mounts one firing-pin movably with respect to the other. A rod carries the movable pin and has a spiral groove. A movable support for the rod has a pin or projection engaging the spiral groove in the rod. The support can be moved so that the movable firing-pin will be turned upon its axis after contact with the other firing-pin. The turning movement is sufficient to rub off any dirt or oxid on the ends of the pins, so that the spark is produced with absolute certainty whenever the pins touch.

ROTARY BALANCED VALVE.—William B. Orr and Charles K. Booth, Macon, Ga. This rotary balance-valve comprises an incased steam-chest provided with a valve-seat in which the valve turns. The valve has side parts opening into the steam-chest, an exhaust-port, and cylinder-ports. A top or cap is provided for the valve-seat. The valve which turns in the seat has an exhaust-cavity, side cavities, and a top cavity. Transverse spring-pressed packing-plates in the valve are in contact with the under side of the cap and are arranged between the side and top cavities. A valve thus constructed cannot leak.

SLIDE-VALVE.—George W. Carpenter and Robert Watson, Nanaimo, British Columbia, Canada. The invention provides a simple slide-valve which can be cheaply made and readily attached to any ordinary cylinder, and which acts as an automatic drain for the cylinder to clear it of condensed steam. The slide-valve used consists of oppositely-arranged, open-ended valve-cylinders fitted in the cylinder-covers. Hollow valve pistons slide in the cylinders and contain inlet and exhaust-ports arranged to register alternately with ports in the cylinders. The pistons are formed with annular flanges at their outer ends, engaging the outer ends of the valve-cylinders when the pistons are moved inwardly. The pistons are longer than the cylinders so as to project inside the main cylinder when slid inwardly. The valve-pistons are instantly released from pressure at the end of the main piston's stroke; while the piston just opening to the steam is assisted to its place by the steam, thus avoiding all jar.

Mechanical Devices.

BOAT DRIVING-GEAR.—John A. Freund, Brooklyn, New York city. The purpose of this invention is to provide an effective means for manually driving propellers in small boats. The mechanism consists of a hand-lever to the lower end of which one end of a link is pivoted, the other end of the link being pivoted excentrically on a gear wheel meshing with a bevel-pinion on the propeller-shaft. The boat can be driven in either a forward or backward direction by the mechanism. The inventor prevents the gear's moving in the wrong direction by means of a double pawl.

WAVE-MOTOR.—Samuel P. Swearingen, Pasadena, Cal. The wave-motor comprises a frame above the water, a float, and a set of arms pivoted to the floats and frame and permitting each float to swing in the direction of movement of the waves. A shaft journaled on the frame carries a ratchet-wheel, which is engaged by pawls on two levers pivoted concentrically with the shaft and extending in opposite directions. Links or bars are connected with the outer ends of the levers and with the float. The device can be used for any purpose for which power is desired.

PAPER-COATING MACHINE.—William H. Waldron, New Brunswick, N. J. The machine is designed to be used either as an adjunct to a paper-making machine arranged to coat paper uniformly on both sides. A delivery device is used consisting of a trough under which the paper passes and in which a roller is contained. An apron, in peripheral contact with the roller, extends outside the trough into close proximity to the upper surface of the paper. The paper is passed around a transverse roller in horizontal alinement with the delivery device and is horizontally returned over the delivery device. The paper is passed underneath a second delivery device, located immediately above the first.

BASKET-STAPLING MACHINE.—John C. Titus, Norfolk, Va. Berry-baskets are formed by taking two pieces of veneer creased transversely to form the bottom and sides; and these two pieces are laid across each other upon a square former with tapered sides. A thin strip is arranged on the inside and another on the outside clamp, the edges of the basket between them. The fastening of these strips to the edges of the basket is the work which the present machine is intended to perform. The former heretofore has been turned by hand successively to present each one of its four sides to the staple-driving devices. The invention provides automatic mechanism whereby the basket-former not only is presented to the staple-driving device, but the basket and former are turned around automatically to present each side. When the four sides are finished, the working mechanism of the machine is automatically stopped; and the driving-wheel runs free while the attendant is fitting the parts of a new basket to the former.

SEWING-MACHINE MECHANISM.—Murney Dendurent, Robinson, Kan. This invention simplifies and improves the feed and shuttle actuating mechanisms so that they contain fewer parts, run more easily, are more readily accessible, and are more quickly assembled and adjusted than heretofore. The improved construction also reduces the cost of manufacture, renders the machine more durable, and involves no complicated parts to gather dust and lint.

Railway-Appliances.

CAR-COUPLING.—Odaville Yates, Dalles, Ore. The coupling belongs to that class employing a side latching-knuckle and a gravity-block designed to hold the knuckle in closed adjustment, to be released by manipulating an attached lever. It is claimed that this improved coupling will effectively couple with a mating member, that it affords means for the safe release of coupled connection from either side of a car, that it may be set to couple by impact, and be locked from release whenever it may be desired.

RAILWAY SIGNAL APPARATUS.—Charles R. Gurr and Herbert Tomlins, 51 Cambridge Road, Hammersmith, London, W., England. The apparatus compensates for variations of length of the wire connections through which the signals are operated and renders impossible the partial or imperfect operation of the signals. The wire connections are kept under constant tension and are at all times free to expand or contract, being normally disconnected from the hand-levers by which the signals are operated. The coupling-up of a hand-lever with the corresponding connecting wire is automatically effected at the moment when the signal is to be lowered; and the connection between the wires and the lever ceases when the signal is returned to "danger."

Miscellaneous Inventions.

DEVICE FOR LIFTING PLATES.—Frederick S. Snyder, Whitehall, N. Y. The device is particularly intended for handling pie-plates without danger of burning the fingers, and is composed of a piece of wire bent to form three arms adapted to grasp the edge of the plate. The device is quickly applied to plates of different sizes, for it is automatically adjusted by pressing two of the arms with sufficient force to lift the plate.

THEATER APPLIANCE.—Ida May Fuller, Forest City, Iowa. By means of this invention it is possible to produce the novel theatrical effect of a fierce fire in which a dancer is apparently moving. The flames are composed of individual tongues, any of which, when separated from the others, automatically returns to an upright position in the fire. The coloring of the illusory flames can be quickly and conveniently changed at will by means which are invisible to the spectators. A smoke effect can also be produced by the same means employed in producing the flames.

STEAM-HEATING PLANT.—James D. Robertson, La Salle, Ill. The purpose of the invention is to provide a steam-heating plant by means of which towns may be supplied with steam for heating or for power. The plant has a generator from which a main leads throughout the system, returning to a point near the generator and into a receiver near the boiler. A valved blow-off pipe passes from the receiver for the purpose of maintaining a contant circulation throughout the system.

VEHICLE-WHEEL.—Lyman H. Zeigler, Millbank, S. D. The purpose of the invention is to produce a wheel which will have a certain elasticity, so that it can yield slightly when brought into contact with inequalities in the road. The inventor has, therefore, devised a wheel comprising a hub and a rim having connecting tension spokes composed of hub and rim sections. Each section is formed of a V-shaped rod having its ends secured to either rim or hub, the complimentary sections being interlocked. Springs exert a sidewise strain upon the spokes.

STRINGED MUSICAL INSTRUMENT.—Andrew E. Bark, Kalispell, Mont. This invention provides an improvement in instruments, such as citherns, whereby the pitch of all strings in a group can be raised or lowered in accordance with the music to be played. Fixed bridges are employed, over which groups of melody and accompaniment strings extend. Two transverse bearings are arranged adjacent to one bridge, and a third bearing is mounted adjacent to the other bridge. For each group of strings a movable bridge is provided, mounted to rock in a bearing. Each of the movable bridges at one end serves to change the pitch of all the strings in the group. Movable bridges at the other end serve to decrease the pitch of some of the strings of the group, thereby changing the chord represented by the group.

MUSIC-HOLDER.—Patrick Bennan, Jackson, Mich. The holder is simple in construction, compact in form, and can be readily carried in a portfolio. On a support a shaft is mounted, provided with retaining-arms at its ends. A finger projects from the shaft and receives one end of a spring coiled around the shaft. A spring-controlled bolt, normally extending below the finger, is arranged for locking engagement with the upper surface of the finger. The bolt serves to regulate the tension of the spring. The device can be used with books or sheets of music.

WAGON-BOX HOLDER.—William A. Crotts, Partridge, Kan. The wagon-box holder comprises a rack-bar secured to the side of the box. A spring-yielding dog is mounted to swing on a standard of the wagon and is adapted to engage a tooth of the rack-bar. A cam-lever holds the dog in engagement with the rack-bar. The box is held from jumping relatively to the bolster. As the top of the bolster or the bottom of the box wears away, the spring-yielding dog will permit the box to move down, so that it can engage a new tooth in the rack-bar.

STRAIGHTWAY VALVE.—David J. Crozier, Brooklyn, New York city. The valve-body has a straightway passage provided with a perpendicular coniform valve-seat and an extension-chamber above the valve-seat. The flanged gate-vale fitting in the seat can be partly or completely elevated. By providing two opposite pairs of notches in the flanges of the valve-gate the gate may be partially turned at different times to alter its position in the seat, thus preventing the gate from wearing away on the sides exposed to the action of the liquid or gas. The regrinding of the valve-gate in its seat can be readily effected while the valve-body is in place by the removal of the extension-chamber from the valve-body and the subsequent unscrewing of the valve-stem from the valve-gate.

COMPOSITION OF MATTER FOR REPAIRING TIRES.—Oliver P. Michael, Marion, Ind. The composition consists of Spanish whiting, Swedish black, glue, and oil of cinnamon. After being introduced into the tire by way of the air-valve and by use of a pump, the composition will readily close a puncture.

APPARATUS FOR PITCHING INTERNAL SURFACES OF CASKS OR BARRELS.—Carl A. Neubecker, Offenbach-on-the-Main, Hesse, Germany. This invention relates to a device for injecting hot, fresh pitch into barrels, so that the old coating is removed and a new one laid on. Difficulties have heretofore been encountered in transferring the pitch from the boiling-pan into the barrel in a suitable manner. The inventor, to overcome these difficulties, employs a heated tank containing the pitch, in which tank a receptacle is placed, through the bottom of which the pitch can flow. Compressed air is employed to force the pitch in the receptacle (simultaneously closing the ball-valve in the bottom) into a discharge-pipe by which it is spayed into the barrel. The device is not so readily overheated as the pumps at present in use; nor is it so complex in construction.

Designs.

PILLOW-TOP.—Raffaelo Astarita, Manhattan, New York city. We have previously had occasion to mention several artistically-designed pillow-tops of this inventor. The present design, representing an automobile coaching party, shows the same taste and skill as its predecessors.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

Chemistry, its Evolution and Achievements. By Ferdinand G. Wiechmann, Ph.D. New York: W. R. Jenkins. 1899. 16mo. Pp. 176.

In a series called "Science Sketches" we find the work noted above. The aim of the author is to enlist the interest of non-professional readers in an exact science. It is scientific without being superficial and is withal interesting. It is a book we can commend to all lovers of chemistry, and teachers of that science should require a portion to be read each day in the class-room.

The Locomotive. New Series. Vol. XX. Hartford, Conn.: Hartford Steam Boiler and Inspection Company. 1899. 8vo. Pp. 194.

"The Locomotive" is always a welcome visitor to the editor's table giving as it does a vast amount of information relating to steam, to boilers, and to science in general. It is admirably edited by J. M. Allen, editor, and A. D. Risteen, associate editor. Among the articles we note "Magazine Science" which we have already commented upon in the Scientific American.

Die Medial-Fernrohre. Eine neue Konstruktion fuer grosse astronomische Instrumente. Von L. Schupmann, Professor an der technischen. Hochschule zu Aachen. Leipsic: B. G. Teubner. 1899. 28 illustrations. 8vo. Pp. 145.

Prof. Schupmann has written a book, which although too technical for the general reader, is nevertheless extremely interesting because it describes his very ingenious method for correcting the unavoidable secondary spectrum in large astronomical refracting telescopes, for producing a more sharply defined image than has hitherto been attainable, and for reducing the length of the tube so necessary in telescopes. He employs a single convex objective, closely to the focus of which a totally-reflecting convex prism is placed. The positive chromatic aberration of the objective is corrected by a concave mirror surface in front of which are placed two concave lenses. The light reaches this correcting device after its pencils have been united in the focus of the objective. The system is essentially different from that now in use and is characterized by a simplicity and ingenuity which augurs well for its general adoption.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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(7832) X. Y. Z.—It depends upon circumstances. Write in full over your signature.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE.

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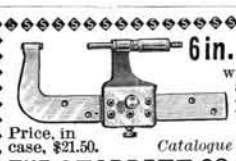

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(*Continued on page 142*)

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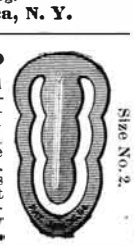
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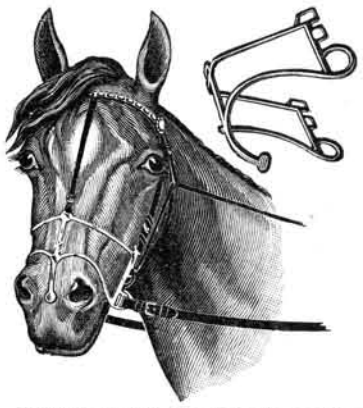

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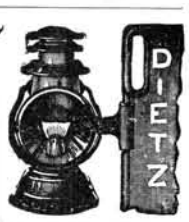

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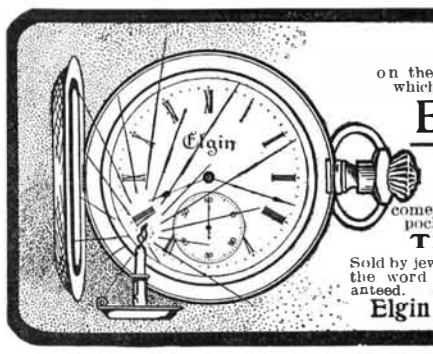

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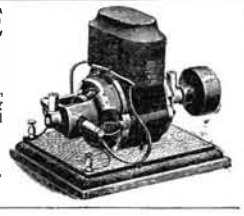

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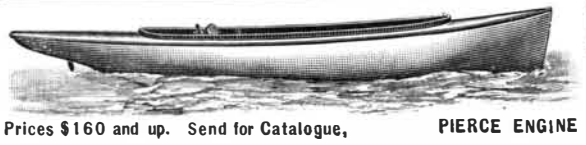

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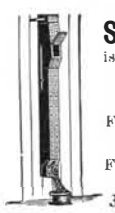

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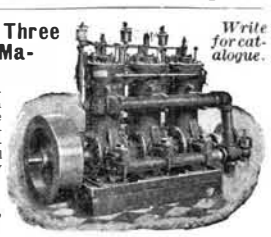

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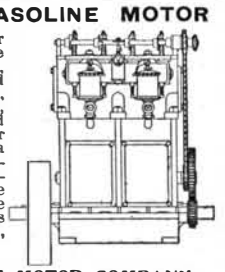

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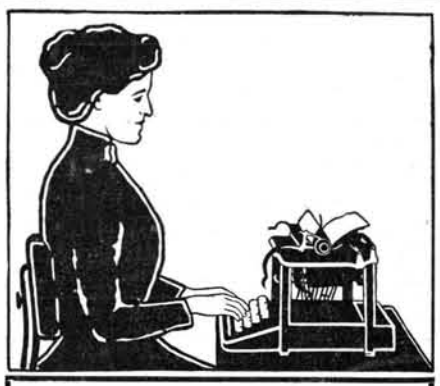

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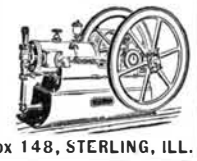

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